SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS. CHEMISTRY AND MANUFACTURES.

Vol. XLVIII.—No. 4. [NEW SERIES.] NEW YORK. JANUARY 27, 1883. [$3.20 per Annum. [POSTAGE PREPAID.]

PERREAUX'S MICROMETER MACHINE.

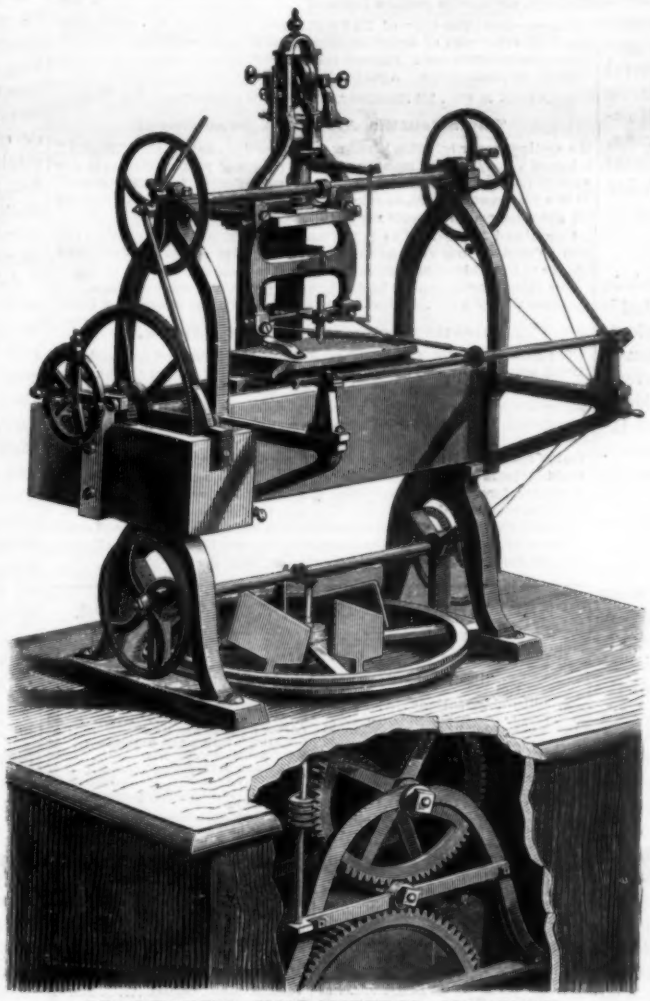
The elegant little apparatus which is shown in the accompanying cut, about one half the natural size, is designed for ruling micrometer scales, and permits of dividing the millimeter into 1,500 parts.

The machine, which is automatic, is actuated by a clockwork movement through the intermedium of very fine silk threads. An endless screw, that engages with a wheel, moves a fly wheel carrying four vanes, which, when the velocity of the wheel reaches its maximum, spread out through centrifugal force and offer a resistance to the air, and thus cause the apparatus to run with regularity. Motion is transmitted to the horizontal axle by two bevel wheels, one of them belonging to the axle of the endless screw, and the other to the intermediate driving axle, which latter carries to the right a very small pulley, that communicates a slow motion by means of a cord to the upper driving axle. To the left of the latter there is a slot arrangement that performs the part of an eccentric, permits of increasing or diminishing the travel, and produces a backward and forward motion in a connecting rod articulated with the slot. The latter, through a click, causes the large ratchet wheel to revolve by fractions, thus bringing about a revolution in the endless screw corresponding to the spacing required in the scale.

The pitch of the screw that moves the carriage by means of a nut is one-tenth of a millimeter. The ratchet wheel has a periphery of 30 centimeters, divided into 300 teeth of 1 millimeter, which gives 3 meters of periphery, or 3,000 teeth for each millimeter of its travel.

By means of the slot above mentioned, which may be varied and regulated at will, this wheel may be caused to revolve by as many teeth as may be required, say 2 teeth for $\frac{1}{1500}$, 15 for $\frac{1}{300}$, 20 for $\frac{1}{150}$, 30 for $\frac{1}{100}$.

In the center of the table of the apparatus there is a carriage which carries a plate of glass fixed by two springs. The tracer, which is placed above this, carries a diamond set into a copper rod, which rises or falls according to the motion of the machine. When this rod is lifted by a second eccentric located in the center of the upper shaft, the ratchet wheel revolves and causes the carriage to move forward; and when the wheel ceases to revolve, the diamond at once falls with extreme precision on the glass, and traces thereon a groove which corresponds in length and depth to the distances traversed. In order to obtain such marks of varying depth, a counterpoise, capable of approaching or receding from the rod supporting the diamond, balances the latter, and, so to speak, grazing the surface of the glass, makes a line corresponding to the ideal, while by carrying the center of gravity more and more toward the diamond, the lines become stronger and stronger. In measure as this counterpoise acts upon the diamond, the lines must, therefore, be further apart.



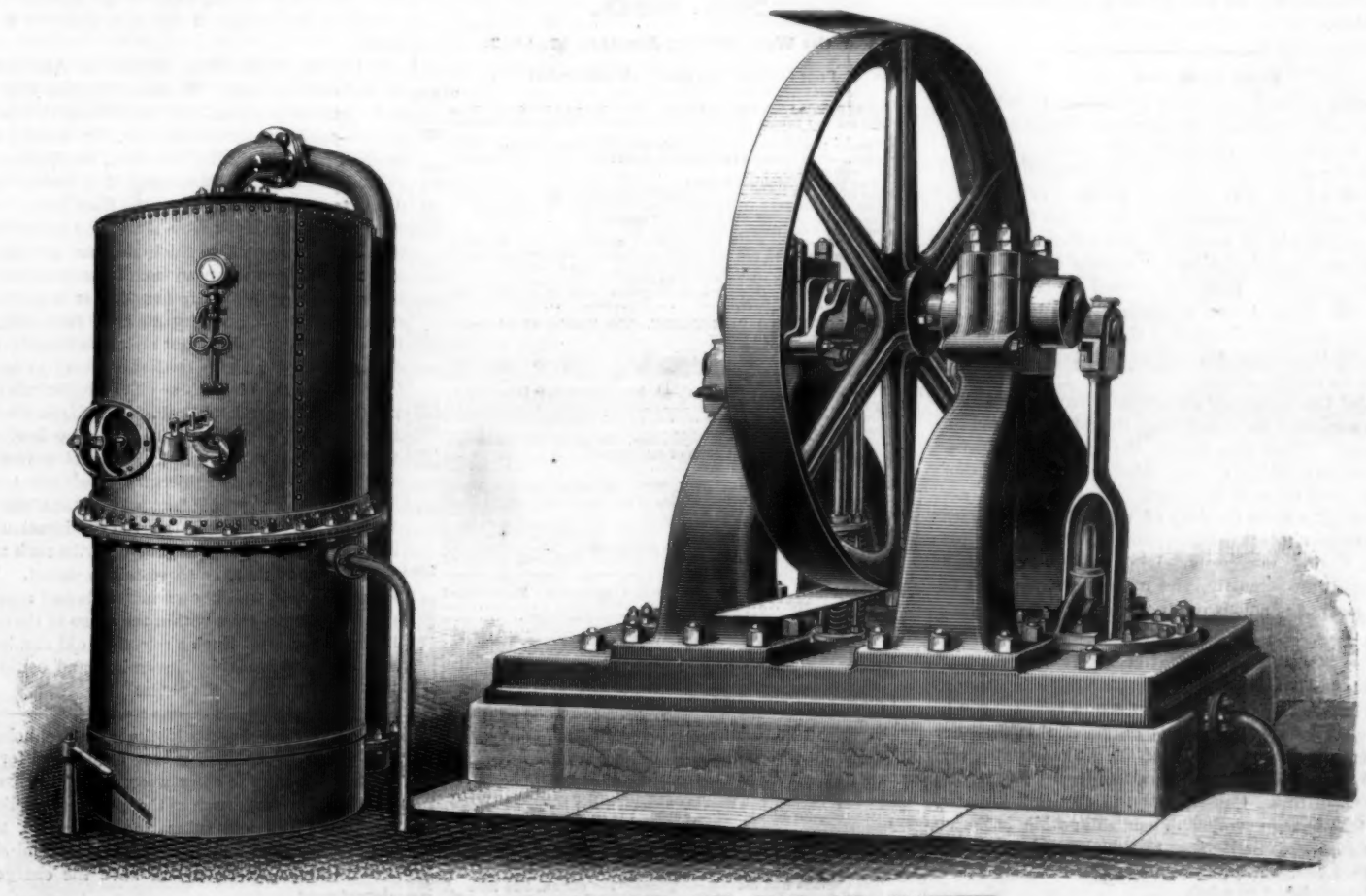
PERREAUX'S MICROMETRIC MACHINE.

The machine is also provided with what is termed a "counter," which is designed to regulate (1) the length of the tenth divisions; (2) of the ordinary lines; (3) of the fifth divisions; and, finally, to render the reading of the lines in the microscope as easy as in ordinary measurements.

In order to obtain very perfect results with this apparatus, it is necessary to guard it against the very feeblest vibrations from the exterior, such as those resulting from the passage of carriages, etc. For this reason it should be used only at certain hours of the night, when all is quiet.—*La Nature.*

GIFFARD'S ICE AND COLD AIR MACHINE.

Among the systems that have been devised for the production of ice and cold air, one of the simplest is that of Mr. P. Giffard, which employs absolutely nothing but air and water, to the exclusion of all those inconvenient and dangerous chemical products that are used in other systems. The apparatus which is shown in the accompanying cut is based upon the principle of compression and expansion of air. It consists of two cylinders in which move pistons actuated by any sort of motor that may be preferred. One of these cylinders, called the compressor, compresses the air and forces it into the reservoir shown to the left in the figure. This reservoir is in two parts, one bolted to the other, the lower one being tubular, and its system of tube being surrounded by cold water, as is the compressing cylinder. The air, compressed to two or three atmospheres, is heated by the compression, according to a well known law. The disengaged heat is absorbed by the cold water, and the air, carried under pressure to the second cylinder (called the expansion cylinder), restores, on dilating, the work due to compression, and produces an extreme lowering of the temperature. Cold air is thus obtained at a temperature varying with the applications that are to be made of it, and which may reach 60 degrees below zero. Such is the machine in general. As for details of construction, we may note, among the improvements devised by



GIFFARD'S IMPROVED ICE AND COLD AIR MACHINE.

Mr. Giffard, the application of pistons of a special kind which are extremely solid, which work very smoothly, and which are absolutely hermetical. The cold air produced by this machine is utilized directly, thus obviating all those complications that are met with in ordinary systems. In the manufacture of ice and the freezing of carafes, this air is sent into a brick chamber containing the water, etc., to be frozen.

The No. 3 size of these apparatus, which requires an 18 horse power and burns 360 kilogrammes of coal in ten hours, produces in this space of time at least 1,000 kilogrammes of ice. The ice, then, costs about one centime per kilogramme, with coal at 30 francs per ton. This price may be reduced one-half, since there are steam engines that do not burn more than one kilogramme of coal per horse and per hour. This same size of machine furnishes 650 cubic meters per hour of cold air at a temperature of 0 degree. The production of ice is still more economical with more powerful apparatus than type No. 3; and if a hydraulic motor be employed, the cost will become almost insignificant. Moreover, the ice being produced at excessively low temperatures, acquires great hardness, and a frigoric power much greater than that obtained with other systems.—*Chronique Industrielle.*

FEVER CAUSED BY LEMONADE.

A remarkable outbreak of enteric fever occurred in Evesham, England, last summer. Fifty-one households were invaded with sixty-eight cases, forty-six of the patients falling ill during the fortnight ending August 8. The houses in which the patients lived were in many instances several miles apart, their sanitary circumstances varied widely, sewers and water supply were entirely different, and the milk supply was derived from several independent sources.

Under these conditions it was no easy matter for the health officers to discover the source of the epidemic. It was elicited however, that all the patients attacked before August 8 had attended Evesham regatta, and that they had all been present in one particular meadow. Further investigation developed the fact that thirty-two of the forty-six had certainly, and eleven had most probably, partaken of refreshments at a certain stall. The other three were in doubt. In one instance two of a party of three drank lemonade, while the third took nothing; the two had the fever, the other escaped. The water used in the refreshment stalls had been drawn from a well near the meadow, the water of which was found to be so contaminated that it was at once closed; the belief of the health officer being that this polluted well had been the immediate source of the epidemic.

Two very obvious inferences may be drawn from this occurrence. One is the propriety of carrying refreshments from home when going on a day's pleasure seeking; the other, the necessity of more critical supervision of the water supplies of pleasure resorts. This should cover not only the water used for drinking or in the preparation of beverages, but also that used in making ice cream and water ices, and in washing drinking vessels and the like. The ice used in beverages is a further source of peril, since the ponds from which it is cut are—as the Newport inquiry demonstrated—too frequently foul, if not infected. The theory that water in freezing clears itself of noxious germs has been shown by careful trial to be untrue. Contaminated water yields impure ice, no matter how slowly the freezing is accomplished.

Face Powders.

It is necessary to raise a warning cry against a most mischievous statement which has recently been circulated, and has already done harm, to the effect that "arsenic in small doses is good for the complexion." It is not difficult to imagine the risks women will incur to preserve or improve their "good looks." No more ingenious device for recommending a drug can be hit upon than that which the authors of this most baneful prescription of "arsenic for the complexion" have adopted. Suffice it to recall the fact that for many years past chemists and sanitarians have been laboring to discover means of eliminating the arsenical salts from the coloring matter of wall papers, and certain dyes once largely used for certain articles of clothing. It is most unfortunate that this hopelessly antagonistic recommendation of arsenic to improve the complexion should have found its way into print. Those who employ the drug as advised—and there are many either already using it or contemplating the rash act—will do so at their peril. So far as they are able, however, it will be the duty of medical men to warn the public against this pernicious practice, which is only too likely to be carried on secretly. It is not without reason that we speak thus pointedly, and urge practitioners to be on the *qui vive* in anomalous or obscure cases.—*Lancet.*

Telephone Statistics.

It is stated that there are 12,325 subscribers in Boston, 4,000 in New York, 2,422 in Paris, 1,600 in London, 600 in Vienna, and 581 in Berlin. It is estimated that there are upward of 100,000 in the whole of the United States, certain small towns, with a population less than 1,000, having 30 to 50 subscribers. Consequently, in these latter places, there is a telephone to every 20 inhabitants; while in Zurich it is 1 to 200; in New York, 1 to 500; Brussels, 1 to 800; Paris, 1 to 1,000; Berlin, 1 to 2,000; London, 1 to 3,000; and St. Petersburg, 1 to 4,000.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, JANUARY 27, 1883.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 369,

For the Week ending January 27, 1883.

Price 10 cents. For sale by all newsdealers.

SHELLAC FOR IMITATIONS OF HORN, IVORY, ETC.

The employment of shellac for the manufacture of various useful articles is now very extensive. Among the most curious applications of this gum are its combinations with woody and fibrous substances, under pressure, in moulds, whereby ornamental and other forms of articles may be cheaply produced. The composition fills the mould with great sharpness, and the most rich and elaborate designs cost no more for their production than plain or commonplace pieces, except in the first cost of the mould. It is of course more expensive to design and carve a mould that shall yield an article that is attractive to the eye by reason of its artistic qualities. But the improved goods thus wrought will sell more readily at higher prices than the ordinary styles.

It may be of interest if we present here some of the well known processes for producing shellac goods. These processes are now free to the public, the patents thereon having long ago expired. The Peck mixture, of 1854, by which the beautiful daguerreotype cases were made, also buttons, handles, etc., was composed of gum shellac and woody fibers, or other suitable fibrous material, dyed to the color that might be required, and ground with the shellac and between hot rollers, so as to be converted into a mass which, when heated, became plastic, so that it could be pressed into a mould or between dies and made to take the form that might be imparted to it by such dies.

John Smith's composition (of 1860) was for the manufacture of buttons and other dress fastenings, the object of the patentee being to attain greater tenacity density, lightness, and delicacy of tint in coloring. He states that he takes one pound of shellac, dissolves it by heat on a flat iron slab, and then mixes with it an equal quantity, by bulk, of ebony dust, or other wood dust; that he then introduces coloring matter and amalgamates the ingredients until the mass appears thoroughly homogeneous in its nature throughout. These components having been well mixed upon a slab or stone while the lac is in a plastic state and under heat, the composition is then to be placed in sufficient quantities in dies of any description prepared and designed for the form of the article to be produced. He suggests that in cases in which it may be desirable that the composition should possess greater density of material, such density may be obtained by the addition of mineral substances, the proportions of which must be governed by the requirements of the case, and when greater tenacity may be desired, that quality may also be obtained by the admixture of a due proportion of vegetable fiber other than wood dust, as, for instance, the shearings of cottons, velveteens, or hemp, flax, or other such like materials.

In 1857 Charles Westendarp, Jr., succeeded in manufacturing a material which was intended to imitate ivory, bone, horn, coral, or other similar substances, natural or artificial; he said it might be used in preference to ivory on account of cheapness and adaptability for billiard balls, knobs, finger plates, piano forte keys, rulers, paper knives, etc. He states that he takes any certain quantity of small particles of ivory, bone, wood, glass, cotton, wool, or other similar articles, either in a coarse or fine powder or in shavings, according to the imitation intended, and combines them, or any of them, or all of them, or as many of them as he sees fit, according to the purpose required, with gums or other resinous materials—such as gum copal, gum shellac, resin, wax, or other glutinous or resinous materials—also using which of the said gums he sees fit for the purpose the materials are required for, either the whole of the said gums or part or any of them.

In 1870 W. M. Welling obtained an American patent for an imitation of horn. In manufacturing it he uses shellac and vegetable or animal fiber, mixed together by well known means—taking "about one part, by weight, of shellac to one-half part, by weight, of cotton, wool, or other animal or vegetable fiber." He finds that it is best to mix the ingredients together in a dry state, the fiber being in short pieces, or in the form of flock, and according to the fineness of the fiber and the extent to which they are ground together, so the materials formed from such a composition will be more or less mottled in appearance similar to horn, and various colors may be produced by the color previously given to the fibrous material. Different pigments may be mixed in the composition to give the desired color or to impart more or less weight as desired. The chief characteristic of the composition is its great strength. The U. S. Circuit Court of New Jersey, Judge Nixon presiding, has lately adjudged the Welling patent to be invalid, and therefore free to the public, on the ground that the subject matter of the patent was old and well known to the public, long prior to the alleged invention of Welling. The court holds that the specification of the alleged invention of Welling does not describe such an advance in the art as should exist to sustain a patent. The patentee selected certain well known materials and combined them in proportions that were within the range of the common knowledge of the art. Such a selection did not, in the absence of a new result, involve invention, and could not properly be made the subject of a patent.

AT the Massachusetts Institute of Technology an alternative course in physics has been established for the benefit of students wishing to enter upon any of the branches of electrical engineering, such as the practical application of electricity to land and submarine telegraphy, the telephone, electric lighting, and the electrical transmission of power. Prof. Charles R. Cross will have the charge of this new department.

ASPECTS OF THE PLANETS FOR FEBRUARY.

VENUS

is morning star, and stands first on the February list, not only because she crowns "the smiling morn with her bright circlet," but also for the incidents she contributes to diversify the planetary history of the month. On the 16th, at 2 o'clock in the morning, she reaches her greatest western elongation. She is then 46° 52′ west of the sun, and, bound to him by an invisible chain, can go no farther. The inner or inferior planets move in this way, oscillating in straight lines east and west of the sun. It is easy to keep the run of these movements, especially in the case of Venus. Those who were eye-witnesses of the transit have a tangible standpoint from which to commence observation, and can readily follow the planet's path until in September she reaches superior conjunction with the sun, and is hidden from view in his radiant beams. Half of her synodic period is completed, as well as her role of morning star. She then passes to the sun's eastern side, becomes evening star, and repeats the same phases in reversed order until she again reaches inferior conjunction. Her whole course is then completed, that is, as she appears to move when viewed from the earth, and she begins over again her unswerving routine among the stars. Thus, on the 6th of December, Venus passed between the earth and the sun, the passage being witnessed by millions of observers. Since that time, she has been moving westward from the sun, rising earlier every morning, passing her period of greatest brilliancy, and turning, like the new moon, more of her illumined face toward the earth.

On the 16th, a change occurs. She reaches her extreme western limit, ceases her retrograde or backward motion, and becomes stationary for a time, as she is traveling directly from us. She then takes on her direct motion, making her way back toward the sun. Observers who watch her course will see that from inferior conjunction to western elongation she rises earlier every morning, and moves with rapid pace. After elongation, she rises later every morning, and moves more slowly, until, at superior conjunction, she rises and sets with the sun.

Seen in the telescope, Venus retains the crescent form until elongation, when she takes on the beautiful phase of a half-moon. After that, she appears in gibbous form until superior conjunction, when her whole disk is illumined like the full moon. She would then be a glorious object in our sky, but she dwindles to small proportions on account of her great distance. For she is one hundred and sixty million miles away, instead of twenty-five million miles, her least distance, and her apparent diameter is 10″ instead of 64″.

On the 20th, at 5 o'clock in the morning, Venus is in conjunction with the small star, Pi Sagittarii, passing 1° 30′ north. The right ascension of Venus on the 1st is 17 h. 49 m., her declination is 19° 10′ south, her diameter is 29·8″, and her place is in Sagittarius.

Venus rises about eight minutes after 4 o'clock in the morning; at the end of the month she rises at a quarter after 4 o'clock.

MARS

is morning star, and gets up a small incident to enliven his monotonous way. He is in conjunction with swift footed Mercury on the 13th, at 6 o'clock in the morning, being 4° 23′ south. The conjunction ranks among invisible phenomena, both planets being too near the sun to be seen. But none the less surely does it take place, for in the risings and settings, the meetings and partings of the planets, there is no change, no shadow of a turning from the accurate calculations that astronomers are able to make for years ahead.

The right ascension of Mars is 20 h. 4 m., his declination is 21° 21′ south, and his place is in Capricornus.

Mars rises now about half past 6 o'clock in the morning; at the end of the month he rises a few minutes before 6 o'clock.

URANUS

is morning star, and is fast approaching the point where he is in the most favorable condition for being seen with the naked eye. He is on the border land between Leo and Virgo. Those who have small telescopes will easily pick him up by sweeping the sky in the vicinity, for he will show a pale sea green disk as soon as he comes into the field of vision, entirely different from the twinkling points around him. Denebola is the nearest bright star in his vicinity, several degrees north.

The right ascension of Uranus is 11 h. 34 m., his declination is 3° 35′ north, his diameter is 3·8″

Uranus rises about half past 8 o'clock in the evening; at the end of the month he rises about a quarter before 7 o'clock.

MERCURY

is evening star until the 5th, and morning star the rest of the month. On the 5th, at 6 o'clock in the evening, he is in inferior conjunction, passing between the earth and sun. If he were then at or near one of his nodes, he would make a transit precisely as Venus did on the 6th of December. As he will not reach his descending node until twenty-three days later, he will pass above the sun and the passage will be invisible. Mercury will not make a transit until the 9th of May, 1891. Transits of Mercury, though much more frequent, are considered of far less importance than those of Venus. Mercury looks much smaller than his fair neighbor as he makes his way over the sun's face, and can never be seen with the naked eye in transit. After inferior conjunction, Mercury passes to the sun's western side, and becomes morning star. The last week in the month, he may be seen rising an hour before the sun, four degrees north of the sunrise point. His conjunction with Mars on the 13th has been referred to.

The right ascension of Mercury is 21 h. 31 m., his declination is 11° 37′ south, his diameter is 9·8″, and his place is in Capricornus.

Mercury sets a few minutes after 6 o'clock in the evening; at the end of the month he rises about half past 5 o'clock in the morning.

JUPITER

is evening star, and ranks *facile princeps* among the three thousand stars that are visible at one time on exceptionally clear nights to observers blessed with good eyes, well trained to note the stars. Nothing on starry pages now open before us is more beautiful than the view he presents through nearly the entire night, as he leads the glittering host of twinkling mysteries from east to west in the grand procession of the azure vault of the sky. He was brighter at perihelion in 1880, but he never was more beautiful, and never trod the heavens with more regal step than he has done and will do in the first two months of the present year.

The right ascension of Jupiter is 5 h. 23 m., his declination is 22° 57′ north, his diameter is 42·4″, and his place is in Taurus.

Jupiter sets about 4 o'clock in the morning; at the end of the month he sets about a quarter after 2 o'clock.

SATURN

is evening star, and, though still a lovely object in the heavens, glowing with soft, serene light, is perceptibly decreasing in size and luster as he travels from the earth and approaches the sun. This is not strange, for on the 8th, at 6 o'clock in the morning, he arrives at quadrature, being just half way on his course from opposition to conjunction. He is then 90° from the sun, rises about noon, and sets about midnight. His motion during the month is direct, and he is traveling northward.

The right ascension of Saturn is 3 h. 10 m., his declination is 15° 32′ north, his diameter is 17·4″, and his place is near the border line between Aries and Taurus.

Saturn sets at a quarter after 1 o'clock in the morning; at the end of the month he sets at forty-nine minutes after 11 o'clock in the evening.

NEPTUNE

is evening star, and reaches quadrature on the 4th, at 11 o'clock in the evening, four days before Saturn and under similar conditions. He is still very near Saturn, there being only thirteen minutes' difference in the time of transit. Neptune will be of little account until September, except to follow in the mind's eye his unseen course in the heavens. Discovered in 1846, he will not complete a revolution round the sun since he became a known member of the solar brotherhood until 2011, seven years after the next transit of Venus.

The right ascension of Neptune is 2 h. 56 m., and his declination is 14° 57′ north.

Neptune sets at 1 o'clock in the morning; at the end of the month he sets about a quarter after 11 o'clock in the evening.

THE MOON.

The February moon fulls on the 21st, at thirty-four minutes after 7 o'clock in the evening. She appears in only three phases during the shortest month of the year—as new moon, at her first quarter, and as full moon. The waning moon is near Venus on the 4th, the crescent and the morning star being only one degree apart. On the 6th she is near Mars, and on the 7th she is near Mercury. On the 13th she is near Neptune and Saturn. On the 16th she passes at her nearest point to Jupiter, and on the 23d she is near Uranus.

When the moon is in conjunction with a planet, she is in the same right ascension or longitude, though she may be several degrees north or south of the planet. As the moon moves eastward at the average rate of 13° a day, she must, during a revolution, pass near all the planets, in the order of their position in regard to the sun. Thus the old moon, fulfilling her course for the present month, passes near the morning stars—Venus, Mars, and Mercury—on the sun's western side. The new moon of the 7th, in the same way, is near the evening stars—Neptune, Saturn, and Jupiter—on the sun's eastern side, and completes the list by her conjunction with Uranus two days after the full. The various phases and motions of the moon form an astronomical study as easily understood and plain to the unassisted eye as it is varied and interesting.

UTILIZATION OF ANTS IN HORTICULTURE.

BY PROF. C. V. RILEY.

Rev. Dr. H. C. McCook has published in the "Proc. Ac. Nat. Sc., Phil.," 1882, pp 263–271, a most interesting paper on "Ants as Beneficial Insecticides." He was led to discuss the question by an article from Dr. C. J. Magowan, which appeared in the *North China Herald* of April 4, 1882, and of which I published a short abstract in *Nature* of June 8, 1882. It appears that in parts of southern China the custom has long prevailed of using ants as a means of protecting the orange trees from the ravages of certain worms. For this purpose the orange growers import from the neighboring hills two species of ants which construct bag-like nests suspended from the branches of various trees. These ants are trapped by means of pig or goat bladders baited inside with lard and applied with their orifices to the entrance of the ants' nest. When the ants have entered the bladders, they can easily be transported and colonized on the orange trees. Bamboo rods are then stretched between the different trees, so as to give the ants easy access to the whole orchard.

Speaking first of the advantage which plants derive from the domiciliated habits of ants, Dr. McCook first raises the question as to whether the known domicile habits of ants are favorable to their encouragement by horticulturists, and brings together a number of interesting facts as to nest-building species. He enumerates the arboreal species which are known to science, and among the few that construct nests like the Chinese species, only two belong to the North American fauna, both occurring in Mexico. No mention is made, however, of the nest-like structures built by several ants occurring in the United States around twigs or among leaves. Mr. Walsh (*Practical Entomologist*, ii., p. 41) thus observed a species of *Myrmica* ("probably the *lineola'a* of Say") building cases around the twigs of the red osier dogwood, and another undetermined species of *Formica* surrounding willow twigs with tent-like structures. Another undetermined species I find quite commonly making nest-like structures on blackberry bushes infested with the blackberry flea louse (*Psylla tripunctata*) and a pale aphid, which live in the crumpled leaves. While these structures may not be called perfect nests, and appear to be built mainly for the protection of aphides, still the fact that the ants are thus "domiciliated" bears on the subject here under consideration. Nor is any mention made by Mr. McCook of the *Azteka mirabilis*, Smith, perhaps the most striking instance on record of protection afforded to a tree by a species of ant domiciliated upon it, of which Dr. Fritz Muller has given us such a vivid picture in his paper, "Die Imbauba und ihre Beschutzer" (*vide Kosmos*, vol. iv., pp. 109–115). This species, already observed by Humboldt, inhabits the natural capacious cavities in the stems of the older imbauba or candelabra trees (*Cecropia*) in South America. Almost every full grown tree contains, according to Fritz Muller, its colony of azteka, and no such tree is ever known to be attacked by the formidable leaf cutting ant which likes to defoliate young imbaubas not yet inhabited by the azteka. Other enemies of young imbaubas, especially a weevil of the genus Baridius, are kept away from older trees by the aztekas, which derive from the tree shelter as well as nourishment, both without injury to the tree.

Dr. McCook further shows that ants are generally carnivorous; that there are species beneficial to agriculture, *e. g.*, the cotton ant, *Solenopsis xyloni*, McC.; and finally that there would be no serious obstacles in the way of successful introduction and colonization of the Chinese ants.

While I agree with these statements, and while I take it for granted that the Chinese arboreal ant is beneficial to orange culture in its native home, still, the question of its introduction is a more serious one than would appear at first glance. The introduction of any species of insect involves many consequences that cannot be predicted with certainty, as experience has already demonstrated. Not only does change of conditions often produce change in habit, but the introduction of a species sometimes very curiously affects the native species. There are species in which we cannot imagine that any change of habit would take place in consequence of their being transplanted to foreign countries, *e. g.*, hymenopterous parasites, and I would unhesitatingly favor their introduction. But in the case of a formicid it would be impossible to predict the consequences of its introduction. There is already one instance on record of an unforeseen inconvenience resulting from the introduction of an ant. A correspondent of *Nature* (June 15, 1882, pp. 159–160) calls attention to the following extract from Tennent's "Natural History of Ceylon," taken from the *Ceylon Observer* for April 26: "To check the ravages of the coffee bug (*Lecanium coffeæ*, Walker), which for some years past has devastated some of the plantations in Ceylon, the experiment was made of introducing the red ants, which feed greedily upon the coccus. But the remedy threatened to be attended with some inconvenience, for the Malabar coolies, with bare and oily skins, were so frequently and fiercely assaulted by the ants as to endanger their stay on the estates."

To return to the particular case of the proposed protection to our orange tree by the introduction of the Chinese ant, it is to be remarked that the principal enemies to that tree in our country are not "worms," but various species of scale insects, all other orange insects being of secondary importance. It has never been proved that ants prey upon and destroy scale insects, and for this simple reason the introduction of the Chinese ant would not be likely to produce any favorable results.

CUT OR UNCUT.

The appearance of the SCIENTIFIC AMERICAN is so much improved when delivered to subscribers with the leaves uncut that for the last two or three issues we have followed that mode of publication. The uncut form is also quite desirable for the neat binding of the paper. We have received, however, a few letters from subscribers and advertisers who say that they much prefer to have the edges of the paper trimmed, as heretofore, owing to its greater convenience. If there are others who share in this preference, we shall be glad if they will signify to us their wishes by a postal card. We should like to have as general an expression of the desires of our readers as possible; and if we find that any considerable number of them prefer to have the leaves cut, we shall try to accommodate them.

Vigilance Necessary in Building.

The difficulty of getting a house built to one's satisfaction is well illustrated in the experience of a Chicago gentleman, as related in the *Sanitary News*, who has just completed a comfortable home. He gave his architect most definite instructions, but he soon found that hardly anything was being done as he had directed. Nobody employed about the building seemed to manifest the slightest interest in his work, and bricks and boards were put together with the utmost disregard of the fitness of things. Lumber was wasted as though it were to be had for the handling. The gentleman came to the conclusion that it would be advisable to stay about the premises, and he did so most of the time, watching as many of the movements as he could. The result was that each day usually opened with tearing down or pulling apart the work of the day previous. For example, he thought he saw something wrong in the laying of the main drain for the sewerage. He reported to the architect, who was to be held responsible for defects. The workmen insisted that everything had been done just exactly as it should have been. The drains were dug up, nevertheless, and it was found that no connection had been made with the street sewer at all. The last section of the pipe had been too short by several inches, and to the crafty drain layer, who was interested in saving time and material, it was not considered necessary to lengthen it. The fresh air duct leading to the furnace had been ordered built of unusual capacity, for the reason that the owner wanted none of the common difficulty about getting sufficient air to ventilate as well as warm his house. He watched the work on this air duct very closely and was congratulating himself that it was well made, but, at last, discovered that the workman narrowed the inlet by drawing in each succeeding course of bricks as he neared the top. When remonstrated with, he said he thought he was doing the proper thing, as the duct wouldn't let in so much cold air if smaller. So in everything done about the house—the workmen had no more conception of the purpose which a healthy, comfortable, and convenient house was to serve than the tools which they used. By hiring an architect to watch them, and then watching the architect himself, he succeeded at length in getting a house in which he takes some pride; but it was at the expense of extra funds, much valuable time, and patient waiting.

The Lay Torpedo.

Colonel Lay has recently submitted his torpedo to a severe test in the Bosphorus by discharging it over a course of a mile at a target only 60 feet long. The path of the projectile was crossed by three distinct currents, of which two flowed slowly upward, and one strongly downward. In addition to this the sea was very lumpy, especially at the junctions of the currents. Yet in spite of the difficulties of the course, the torpedo was steered without trouble through the space separating the boats which represented the target, and after passing them was caused to turn round and return to the spot where the examining committee, among whom were Woods Bey, and Frost, Hassan, and Hobart Pachas, was stationed. In the Lay torpedo the steering is effected by electricity transmitted through a cable, carried in the body of the torpedo and paid out as it runs. Thus the line does not require to be dragged along, and forms no hinderance, either to the speed or the manipulation of the projectile. The course is followed by means of two small sight rods, which project above the surface of the water, and can be seen for a mile or so by aid of a good glass. These are the only parts of the apparatus that are visible when the torpedo is in motion. At rest it projects about an inch above the surface, but immediately it starts it buries itself completely, and if the sight rods be lost it is difficult to again find them. At night the rods carry lamps that direct the light backward, and are invisible to the enemy. The torpedo experimented upon is not of the latest pattern; it is a cigar shaped boat 26 feet long, and 24 inches in diameter at the largest part, and weighs when fully prepared for action, with 90 pounds of dynamite, one and a half tons. In the more recent examples the speed has been increased to 12½ knots, and the disturbance of the water lessened by the use of twin propellers, while the charge of explosive has been augmented to 150 pounds.

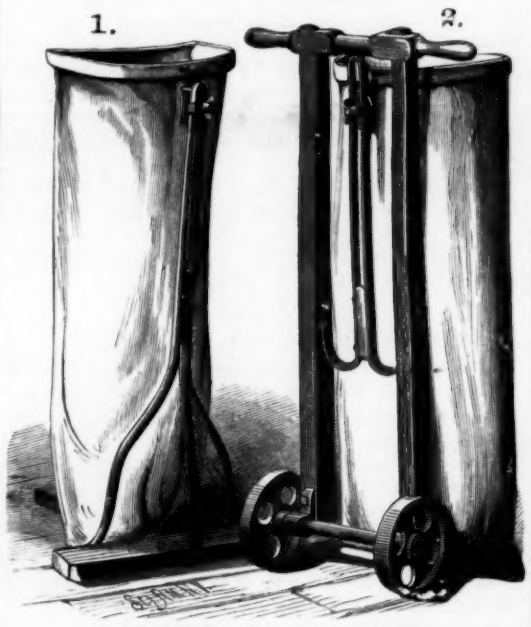
Engineering says that the results of the trial were so satisfactory that a contract was prepared between the Ottoman government and Messrs Lay and Nordenfelt. At the last moment, however, this fell through, owing to the request of the United States minister that no decision should be come to until the Berdan torpedo could be tried also. It is claimed for this latter that it will break through the steel wire netting that is used in the English navy, and which is believed both here and in Turkey to offer a good defence to both the Whitehead and the Lay torpedo.

According to the *Journal des Fabricants de Sucre*, the production of beet root sugar in Europe this year amounts to 1,920,000 tons, an increase of 127,500 tons over last year. Germany is still the greatest producer, heading the list with 675,000 tons; Austrian-Hungary ranks next with 450,000 tons; France third, with 410,000 tons; Polish Russia fourth, 275,000 tons.

NEW BAGHOLDER.

A convenient and inexpensive device for holding bags while being filled and for moving them about is shown in the engraving. The holder may be used separately or applied to the truck, or it may be attached to platform scales so that the bag can be filled and weighed at the same time. It can be readily attached and detached, and while it saves the labor and wages of one man it does the work better.

It is made entirely of wrought iron and is very light and readily managed. It is manufactured in various sizes to adapt it to bags in ordinary use. It is adjustable up and down on its support, and the hoop to which the bags are applied adapts itself to bags of various sizes. The construction will be readily understood by reference to the engraving. All thrashermen, millers, warehousemen, farmers,



BAG HOLDER AND BAG WAGON.

and others who have use for an article of this class will appreciate its advantages at a glance.

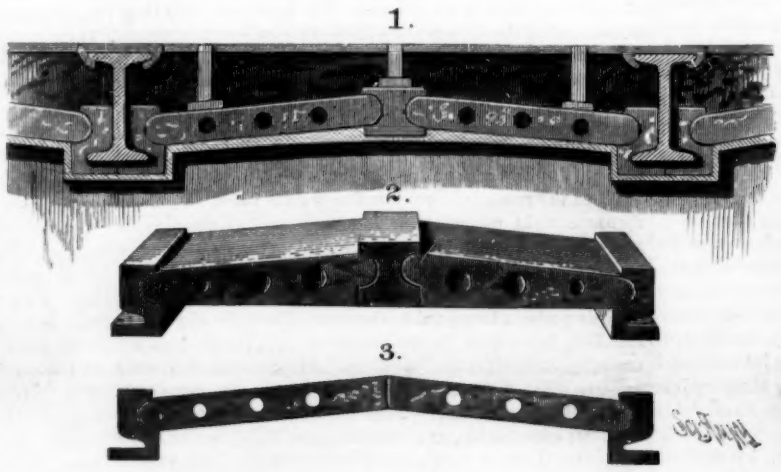
Further information in regard to this useful invention may be obtained by addressing the manufacturer, Mr. C. F. Dinkle, Carlisle, Pa.

NEW FIREPROOF FLOOR AND CEILING.

The frequent recurrence of disastrous fires in which scores and often hundreds of lives are sacrificed to improper construction and inflammable building material, demands the universal adoption of fireproof construction wherever there is the slightest question as to the safety of occupants.

Walls of brick, iron, or stone, beams of iron, and floors and ceilings of incombustible material are the usual elements of fireproof construction. While the walls and the beams are much the same in all fireproof structures, the filling between the beams differs. We give an engraving of one of the latest and best forms of filling, which consists of buttresses planted against the beams resting on the lower flanges and extending partly across the lower edge of the beam, and struts which with a central or key piece form a toggle arch between the beams. The engraving shows three forms of this filling. In Fig. 1 the struts are flat, with rounded ends fitting in corresponding bearings in the buttresses and in the key piece. The device shown in Fig. 2 is nearly the same, the only difference being the horizontal face on the under surface of the arch. Fig. 3 shows an arch in which the key is dispensed with, the struts abutting in the middle.

The floor is laid on strips placed on the struts or buttress blocks and key, and the spaces between its strips and above the struts are filled with concrete. The under face of the arch is finished in any desirable way. The great advantage of this system is that the arch can be placed without the use of scaffold or stages of any kind, thus greatly cheapening the construction. A pair of buttresses and a pair of struts with the key are placed, then other buttresses are placed on the beams, and another pair of struts placed in position with their ends resting on the buttress and on the rebate and key projecting from the first pair of struts, the buttresses being arranged to break joints with the struts. Another pair of buttresses is now inserted, then another pair of struts placed, and so on. This filling adjusts itself automatically to its bearings, and is strong and well calculated to perfectly insulate one floor from the effects of heat in another. To make the filling as light as possible without impairing its strength, it is apertured lengthwise. This device is the invention of Mr. Andrew J. Campbell, of 552 to 558 W. 33d St., New York city.



CAMPBELL'S FIREPROOF FLOOR AND CEILING.

Pure Bred, Thoroughbred, and Full Blood in Stock Raising.

The three principal designations of stock are: 1, pure bred; 2, thoroughbred; and 3, full blood.

1. A pure bred animal is one descended from a pure or original race without intermixture of other blood. The Devons are a pure race of cattle. The wild cattle of Chillingham may be called a pure race. The buffalo is a pure race. The true Arabian horse is a pure race. Wild animals are pure races.

2. A thoroughbred is an animal originally of mixed lineage, but which has been interbred so long without recourse to foreign sources that the progeny comes true, or nearly true, to the type established. The Short-horns and Herefords among cattle and the racers among horses arising from a mixed lineage are thoroughbreds. That they have not yet ceased the endeavor to improve these breeds, through the careful selection of sires and dams, always carefully within the line of the oldest and well defined blood of the varieties from which they originally sprang, is proof that breeders do not believe that their ultimate excellence has been reached.

3. The term full blood indicates neither purity of blood nor thorough breeding, except relatively. An animal of the common blood of a country may be bred indefinitely to a pure blood, and yet never reach purity. The first cross would be one-half blood; the second cross, three quarters blood; the third cross, seven-eighths blood; the fourth cross, fifteen-sixteenths; the fifth, thirty-three thirty-fourths of the pure or the thoroughbred blood, if none other has been used in the cross. Yet the resulting progeny would always contain a fraction of the original or pure blood. Yet often seven-eighths, and especially those fifteen-sixteenths bred, show the characteristics to so great a degree that none but experts can distinguish from outward observation between the full blood and the pure or thoroughbred type. Hence seven-eighths or fifteen-sixteenths bred animals are by courtesy sometimes called full bloods.

A grade is an animal containing some pure or thoroughbred blood. A seven-eighths grade is sometimes called a high grade.—*Prairie Farmer.*

How the Pictures in the Louvre are Cleaned.

A correspondent of the Philadelphia *Evening Bulletin* has taken the pains to find out how the galleries and the pictures in the Louvre are kept clean. On Mondays the palace is closed; it is then that the weekly cleaning takes place. The first thing done is to cover the floor with damp sawdust to the depth of an inch or so. Oak sawdust is used for the boards, and elm dust for the marbles. This is allowed to remain some time and is then removed, and with it goes every particle of dust or dirt which may have adhered to the floor. Then the men buckle on to their feet large stiff brushes, and, armed with a stout stick, to one end of which is fastened a great piece of prepared beeswax, they first rub the floor with wax, then skate over it with their brushes, and finally give it the finishing polish with a great woolen cloth made expressly for this purpose. The same cloth is passed daily over the floor before the opening of the museum, which is all that is required until the following Monday. In this way no dust arises, and the pictures need rarely to be cleaned. When this becomes necessary, which happens about once in four or five years, the museum is closed for several days. No one is allowed to touch a picture unless the "Conservateur du Musee" be present. The pictures are taken down, and it is the "Conservateur" himself who places a thick sheet of clean wadding over the painting, pressing it down gently in such a way that every particle of dust adheres to the wadding. After this is done, a thin coat of oil or some mixture which replaces it is rubbed on, and the picture is not again touched until the next general house cleaning.

An Extensive Irrigating Project.

There has just been opened in the Punjab, India, the Sirhind Canal, one of the greatest works of the kind in the world. The canal is over 500 miles long, with subsidiary channels measuring some 2,000 miles more. The canal is designed to irrigate an area of over 1,200 square miles. It is fed by the Sutlej River, and great and numerous engineering difficulties were overcome in its construction. Three-quarters of a million acres will be brought under cultivation by means of this gigantic work.

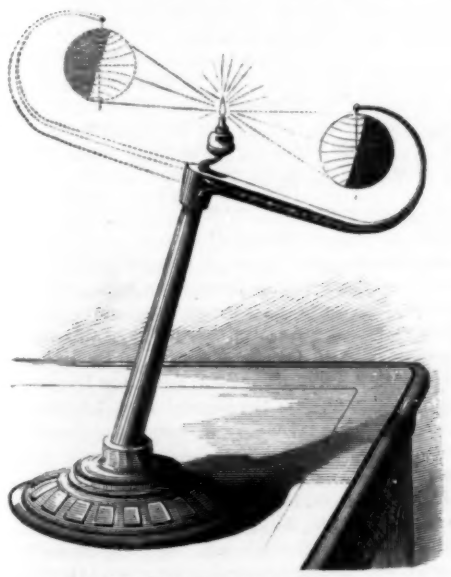
Easy Deception of the Senses.

The ease with which persons fall under hallucinations of special sense is illustrated as follows by M. Yung (in a recent communication to the Helvetic Society of Sciences): The operator places eight cards on a table, in positions corresponding to forehead, eyes, ears, nose, mouth, and chin; he pretends to "magnetize" them, and also some person in the company, and then goes out, while the magnetized person is required to touch any one card. The operator, having returned, notes the action of a confederate, who scratches a part of his head corresponding to the card touched. Then he commences an innocent comedy, passing his hand carefully over the cards, and on reaching the touched card, seeming to experience a strong shock. The observers are surprised, of course. One of them is asked to go out and repeat the experiment. It is assumed that a certain card has been touched. Passing his hand over the cards, he indicates, in nine cases out of ten (M. Yung says), a particular card as giving him a shock, and if the company be instructed to support his idea of that being the "correct card," he is confirmed in his illusion, which may be successfully repeated. Of 85 persons tried, M. Yung found only 9 who refused to indicate a card, not having experienced any sensation; 53 said they had exactly the sensation announced, and 23 described some different sensation.

NOVEL TELLURIAN.

We give an engraving of a very simple instrument for illustrating the causes of day and night and of the seasons, which is free from defects common to tellurians generally. As tellurians are made, ordinarily, the earth is represented as moving in an orbit the plane of which is at right angles to the sun's axis. Consequently the earth has to be tipped or tilted toward and away from the sun in order to show the changes of the seasons. In this improved instrument this difficulty is avoided by causing the earth to move in an orbit the plane of which is at an angle of twenty-three and one-half degrees to the axis of the sun, which is about the angle that the "equator" and the "ecliptic" make with each other, the globe which represents the earth being suspended at a point that corresponds with the north pole, and depends upon its gravity for keeping its axis vertical or parallel with that of the sun during its entire revolution around the sun. By this mode of suspension and by the inclination of the plane of the earth's orbit, no manipulation to tip or tilt the earth in different directions in order to show the changes of the seasons is necessary, and the globe representing the earth may be readily turned on its own axis to indicate its diurnal motion.

Thus the figure in the engraving indicates, on its right hand side, the rays of light as falling twenty-three and one-half degrees beyond the north pole or point of the earth's suspension. This represents the position of the earth in summer. On the other hand, when, by the motion of the earth in its orbit, the rotating arm, with its suspended globe, reaches the position indicated by dotted lines at the left hand of the figure in the drawing, the rays of light as falling on the earth will indicate summer in the southern hemisphere. In this way, as the arm carrying the suspended earth is revolved, the light will fall upon the earth in such



SPICER'S TELLURIAN.

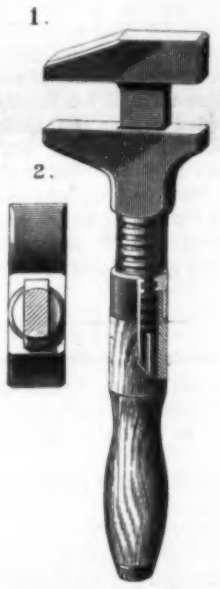
manner as to show the different seasons and their intermediate changes.

Of course, in an instrument of this simple construction all the natural or true conditions of the earth and sun relatively to each other are not shown, and the earth should be made to move in an elliptic instead of a circular orbit; nor is there any special provision for rotating the earth on its own axis three hundred and sixty-five times and a fraction each revolution it makes around the sun; but the manner in which the earth is carried admits of its being turned at intervals to illustrate its diurnal motion and the changes of day and night, as the rays of the sun fall upon a constant varying half of its surface, leaving its varying remaining half in the shade.

This simple scientific instrument has been patented by Mr. Jeremiah Spicer, of Taylor's Island, Md.

IMPROVED WRENCH.

The engraving represents a very simple, strong, and inexpensive monkey wrench recently patented by Mr. W. A. Bradford, of Goshen, Ind. It is composed of but three parts: the main jaw having a squared shank rounded at the end; a movable jaw having a squared bearing fitted to the shank of the main jaw, and provided with a split screw a portion of which lies on each side of the shank of the main jaw; and a handle fitted to the rounded part of the shank of the main jaw, and provided with a nut that engages the screw of the movable jaw. By turning the handle the movable jaw is moved quickly out or in, and may be clamped tightly on a nut, so as to hold it with a vise like grip if desirable.



BRADFORD'S WRENCH.

The simplicity of this wrench, the facility with which it may be manufactured, the quickness and convenience of its adjustment, as well as strength and durability, will recommend it to both manufacturers and users.

Further information in regard to this invention may be obtained by addressing the inventor as above.

The Harvesting of Ice.

The season has again come round when large quantities of ice are collected and stored with a view to its being used during the summer months in connection with our food supplies. Some of it is actually mixed with foods and drinks, more still is brought into close contact with such articles of diet as fish, poultry, butcher's-meat, etc., in order that it may act as a preservative. Unfortunately, however, but little regard is had to the sources whence the supply is derived, and after every frost carts laden with ice which has been collected from the surface of ponds, canals, and streams which would be studiously avoided as water supplies, may be seen passing along our streets to the shops of tradesmen dealing in articles of food and drink. That the use of such ice for the purposes to which it is put is not without risk has been shown both in this country, says the London *Lancet*, and more especially in America, where, in the warm weather, ice enters largely into the list of table requisites; indeed, it has been further proved that ice has acted as the vehicle of disease germs capable of conveying enteric and scarlet fever, and its use has also been associated with conditions of ill health which have much resembled these and other specific fevers. The carelessness which has obtained in selecting sources for the collection and storage of ice has been largely due to the fact that there is a very general opinion that in the act of crystallization water practically rids itself of all its injurious qualities, however offensive it may be in its liquid state, and acting on this view, it is notorious that ice for domestic use has been, and still is, collected from streams receiving sewage, ponds that are offensive in summer time with decomposing vegetable growth, and similar sources.

There is also a sufficient amount of truth in the general opinion as to the process by which noxious and foreign matters are eliminated from water during the act of freezing to lead to some lack of caution on the part of the uneducated, but recent experience has clearly shown that the process of purification is only a partial one. In connection with this subject, the *Lancet* copies from Dr. Wight's "First Annual Report to the Board of Health of Detroit," which includes a copious reference to certain recent experiments by Mr. C. P. Pengra, an analytical chemist. In the first instance, urea, as a representative of the crystalloids, was mingled with water, which was then frozen; and it was found that whereas 100 cubic centimeters contained 0·83 gramme before freezing, they still retained 0·50 gramme when in the form of ice. Very similar results followed in experiments made with urea as found in urine, and with other substances, such as grape sugar.

The next experiment was with the colloids; albumen, both from the egg and from a case of albuminuria, being taken as a sample, and it was shown that the amount retained in the frozen mass was greatest at its under and least at its upper surface. Thus 50 cubic centimeters from the lower third contained 6·87 grammes, the same quantity from the middle and upper thirds containing 4·19 grammes and 8·0 grammes respectively.

Other experiments with the same material showed that the purification which did take place amounted to about twenty per cent of the total admixture. The results would, doubtless, vary according to such circumstances as the rapidity of freezing, but since in all the instances recorded the specimens were frozen naturally, they amply suffice to show, as the author contends, that pure ice can only be procured from water free from impurities, and that ice for domestic purposes should never be collected from ponds or streams which contain animal or vegetable refuse or stagnant and muddy contents.

Station Building on the C. P. Railroad.

When the building superintendent of the Canadian Pacific commenced the work of erecting stations on July 1, the track layers were over 100 miles in advance of him, but at the close of the year the last station will be built at the end of the track. During the season he has constructed twelve stations, twelve section houses, eleven permanent water tanks, and sixteen temporary ones. He has had a force of 250 men in his employ, and his pay roll has amounted to $16,000 per month. His plan of operations has been similar to that employed in track laying. One gang of men would be detailed to erect the frame of a station house, and then sent on to the next point, while their places would be filled by the next carpenters, roofing in the building, putting in the floors, etc., who would in turn be superseded by the joiners and plasterers. This course was followed throughout the season, four or five buildings being in process of construction at the same time, thus avoiding delay.

IMPROVEMENT IN PARASOLS AND UMBRELLAS.

The great item of expense in parasols and umbrellas is the frame, and, as every one knows, a good frame always outlasts the cover. For this and another reason to which we shall refer, it is desirable to have the cover of an umbrella removable. The engraving shows an improvement in umbrellas which accomplishes this very desirable end.

The ribs of this umbrella are of U-form in cross section, except at the points when they are round.

Fig. 1 shows the invention complete; Fig. 2 shows the method of fastening the cover to the ribs; and Fig. 3 shows the notch plate in which the upper end of the ribs are secured; Figs. 4 and 5 show the fastening rings and the ties. Fig. 6 is a sectional view of the cover, rib, and tie, showing the fastening at the middle of the rib. Fig. 7 is a transverse section through the end of the rib at the lower edge of the cover, and Fig. 8 shows a modification of this fastening.

One of the interchangeable covers adapted to fit a single frame is slipped over the top of the stick of the frame, the aperture in the cover passing over the end of the stick being re-enforced with a ring of leather. This ring fits down upon the notch plate and is held in place by means of a rubber ring, which is sprung into place and confined under a metallic collar upon the stick, so as to bear firmly upon the ring of the cover, as shown in Fig. 2 in the engraving. The ring of the cover it kept from turning upon the handle by

LOCKLING'S IMPROVED UMBRELLA.

means of short points projecting up from the notch plate. When the cover is thus secured upon the stick, it is secured to the ribs either by means of cord strings or of split rings sewed to its under side to spring into eyes or loops upon the ribs, about midway of their length and at the ends thereof.

A lady provided with one of these umbrellas will be able to have at a small expense a cover corresponding with each change of suit. The time required to make the change of covers is very little. The importance of this improvement will be appreciated by such as are obliged to purchase expensive parasols for each style or color of dress, and also by those who are accustomed to throw away sound frames when the cover is spoiled.

This invention has been patented in this and foreign countries by Mr. Theodore D. Lockling, of Panama, United States of Colombia.

VEGETABLE COLORING MATTERS.

BY PROFESSOR AUGUST VOGEL.

There is nothing real about colors; they are not actual substances, but merely states or conditions of matter that produce certain impressions in our eyes. They are due to the different ways in which light is decomposed by different substances, some rays being reflected or thrown back from the surface of a body, others being retained or absorbed by it. For example, we say that a thing is blue when its surface absorbs all other rays of light, reflecting only the blue ones to our eyes. It frequently happens that persons are unable to distinguish one color from another; this is certainly the best proof that colors are not substantial, but merely children of the light, or as Goethe expresses it, "facts of light."

Nevertheless, although colors are not real entities, it is undeniable that they exert a certain influence upon mankind; they make their presence felt not only on the eye but on the feelings; colors have an æsthetic, a moral, and a mental influence. While red light, for example, excites alarm or moves us to activity and bustle, blue light depresses us with a melancholy quiet and promotes silence.

A glance at the bright world of flowers reveals a most wonderful variety of vegetable colors. The scale of colors exhibited by substances of the mineral kingdom seems insignificant in comparison with the brilliant variety of colors spread lavishly before us by nature in the vegetable kingdom.

Of all vegetable pigments the green of the leaf (chlorophyl) possesses the greatest interest for us, because it is the most widely disseminated in the vegetable kingdom, and because, as we very well know, it bears a very intimate relation to the life and growth of all green plants. Even a superficial consideration of chlorophyl discloses much that is wonderful and striking. Plants that grow in the dark are not green, we know, but of a light yellow color; under these circumstances the formation of the green pigment is, as a rule, entirely suspended. From this it would seem that the production of chlorophyl depends upon the action of light, or is, at least, very intimately related thereto. And yet, if the chlorophyl is removed from the plant by any solvent, as alcohol, ether, or the like, it is rapidly bleached and destroyed by the action of light. This pigment, although formed by the action of light—this child of the light—cannot bear exposure to the light; it is a very fugitive color.

It is a very interesting fact, and worthy of notice, that in the coniferæ the germinating plant is green, although the light may be completely excluded, and the germination have taken place in absolute darkness. It was first noticed that the germs of the fir, pine, etc., produced this green pigment when light was entirely absent, in the deepest darkness, or when covered with earth. My own experiments have shown that plants raised from seeds of the fir in moist sawdust, where the light was entirely excluded, exhibited a decided chlorophyl production, although the plants were not so strong as those grown in daylight.

Yet here, too, there is one exception. The larch (*Larix europæa*) is the only conifera that does not form green sprouts in the dark.

Recent chemical investigations have resulted in gradually supplanting nature in the production of dyestuffs. It is scarcely a decade yet since madder red was first made artificially and substituted for the madder root, while at the present day attempts are made to retire from active service our time-honored indigo plant, and to form in large kettles by the ton what was formerly produced sparingly in the quiet cell. The discovery in 1868 of alizarine, the artificial red of madder, has rendered the cultivation of this plant unnecessary, thus releasing large strips of land, especially in France.

In 1862 there were 20,463 hectares (50,000 acres) of land in France alone devoted to the cultivation of madder, which have since been restored to grain raising, and thus acquired a great interest for agriculturists. The successful preparation of artificial dyestuffs has been chiefly due to German chemists, as has been clearly shown by my highly esteemed friend, W. Von Miller, in his excellent work entitled "Old and New Dyes." So, too, the technical preparation of artificial pigments is a specific German industry.

Is it not surprising that the English, who excel all other nations in their manufactures, should be outdone by the Germans in such an important branch of industry? Is it not a remarkable phenomenon that this practical, independent people, who are too proud to praise foreign virtues, should send their experts to Germany to obtain a knowledge of artificial dyes and the methods there in use for making them? Nay, more, the English (the Americans included) send their tar to Germany and then buy back the colors made from it at a high price. The prophetic words of Liebig have been fulfilled: "We believe that on the morrow, or the day after, the brilliant dyes of madder, or the useful quinine and morphine, will be made out of coal tar. The most recent discoveries concerning organic basis permits of our expressing such a belief without any one's having the right to laugh at us."—*Humboldt, December*, 1882.

A Museum for Merchants.

One of the most noteworthy recent additions to the city of Brussels is the opening of a commercial museum under the control of the Minister for Foreign Affairs, the object being the exhibition of specimens of both raw materials and manufactures of all countries, so that Belgian merchants and makers can practically study the requirements and necessities or foreign customers. The classification of this most useful institution is such that the visitor can not only see the origin of each specimen, but also trace its industrial value to the end; and for this purpose his inquiries are facilitated by an information bureau, where all facts can be obtained respecting the character, uses, and cost of each sample. In this same office are plans and specifications of all public contracts and improvements, and attached to it is a library replete with technological works, catalogues of foreign museums, journals of manufacture and commerce, and all the literature of trade and labor. While specimens of foreign manufactures are largely exhibited, special attention is paid to those raw materials which appear to be capable of being utilized by the Belgian industrial establishments. A feature of considerable interest is the packing and finishing room, in which the finest examples will be shown of packing, labeling, and general preparing for the markets, for there is no doubt that the outward dress of goods is of great importance, and that the general style of Continental packing is awkward and unattractive. The museum will be continually fed with new subjects by the Belgian consuls and foreign agents, who are enjoined to collect all kinds of material, patterns, dress, etc., which may serve for comparison, instruction, or imitation. The public have the run of the museum daily, except Sunday, from 9:30 in the morning to 4 in the afternoon, without payment, while to all *bona fide* inquirers information is freely and gratuitously given by the information bureau.

The Testing of Mixed Tissues.

Mr. Henri Danzer has recently submitted to the Society of Industrial Arts of Lyons, France, a method of analyzing mixed tissues, which he claims to be very positive in its results.

He says: It is well known that textile materials are classified in two great divisions:

1.—Vegetable Textiles.
2.—Animal Textiles.

This distinction of origin enables us to detect in any tissue the pure vegetable or pure animal fibers, or if the two be mixed. To this end nothing more need be done than to ravel any number of threads of the tissue and burn them in any flame.

Threads of animal origin, such as wool, goat hair, alpaca, silk, etc., form a spongy, swelling coal, which makes combustion difficult, leaving, relatively, an abundance of ashes.

Vegetable fibers, such as cotton, flax, hemp, etc., on the contrary, burn with a bright flame without appreciable residuum and almost without smell.

Another method consists of boiling for some time a mere fragment of tissue to be examined in nitric acid. Under the influence of the acid, silk will be colored a light yellow, wool a dark yellow, while cotton, flax, hemp, etc., remain white, which can be ascertained in one moment.

This experiment will determine the nature of the tissue. If it is desirable to know the proportions of the different component fibers, a piece of the tissue must be carefully washed with soap, to destroy all greasy particles. After a thorough washing, the material must be dried. A sample of five grammes will be sufficient for a complete trial. It is to be placed in a bath of caustic soda, and boiled until the animal substances are completely dissolved. The contents of the bath must then be poured upon a filter. The lye will quickly pass through, while the undissolved fibers will remain upon the filter. A thorough washing in an abundant supply of clear water will purify them from the soda. When dried the loss of weight will determine the amount of animal matter.

A Butterfly Larva Injurious to Pine Trees.

In the course of some remarks recently made by Dr. H. A. Hagen before the Entomological Society of Ontario, at its meeting in Montreal, he gave an interesting statement of the injury of *Pieris menapia* to pine forests in Washington Territory, and particularly in Colville valley, twelve miles from Spokan.

The caterpillar, found in all stages, destroys mostly the yellow pine, but in some rare cases tamarack. The eggs are of the usual Pieris form, and are laid in a series of a dozen or two in a straight line on the leaves. The caterpillar eats all the leaves except the fascicle at the end. Then all the tips turn upward, and give to the tree a chandelier like appearance. The larva comes down from the tree on a thread, some fifty feet or more. In the middle of July, near Spokan, a number of old males were found; higher up in the valley they grew more numerous, in some places many thousands being observed on one tree, presenting the appearance of snowflakes in the distance. The larva was found in all stages and the chrysalides were abundant.

On July 24, females and fresh males abounded. They paired at once, and laid eggs the same day. The destruction seems to have been great but localized, and Mr. S. Henshaw and Mr. H. R. Stretch assisted Dr. Hagen in his observations.

The species has long been known to differ from the rest of its genus in its pine feeding habits, and to be uncommonly numerous, at times, in various parts of the Rocky Mountain region; but we have never heard of such disastrous consequences as those reported by Dr. Hagen.—*American Naturalist.*

The Nutritive Properties of Rice.

The increase in the consumption of rice has lately attracted the attention of several men of science in Germany, and among other investigations, according to the *Lancet*, an attempt has been made by Professor Voit to discover the relative capacity which various forms of nourishment possess of being incorporated into the system. He has drawn up the following table of the percentage which remains in the body, and of that which leaves it:

	Percentage incorporated.	Percentage which is not retained.
Meat	96·7	3·3
Rice	96·1	3·9
Eggs	94·8	5·2
White bread	94·4	5·6
Maize	93·3	6·7
Potatoes	90·7	9·3
Milk	88·9	11·1
Black bread	88·5	11·5

According to these results (the *Bremer Handelsblatt* remarks), meat and rice leave the smallest amount of residuum, and occasion the smallest excessive exertion to the digestion, and, in fact, introduce the minimum quantity of ballast into the human frame. Dr. König, of Munster, considers that the fact of large masses of population living on rice is easily accounted for; and in summing up the information collected upon the subject, Professor Voit remarks that potatoes, when consumed in excessive quantity, fail to nourish the frame effectively, make the blood watery, and render the muscles weak. Apart from the subject dealt with in the table drawn up by Professor Voit, the question of the relative nutritive value of rice and potatoes has been investigated by Dr. König, who is of opinion that if similar quantities of both articles are compared, the former possesses four times the value of the latter in really nutritive properties. It is also remarked that the introduction of rice as a substitute for potatoes is facilitated by the fact that no such variation takes place in its quality as is the case with the potato, which is liable to be materially influenced by the effects of unfavorable weather.

The Sinking of the "Austral."

An accident which recalls the historic disaster to the Royal George of the British navy, at Spithead, many years ago, occurred in Neutral Bay, Port Jackson, near Sydney, Australia, last November.

The Orient steamer Austral had gone to Neutral Bay, to take in coal before sailing for England, and on the morning of the accident had been receiving coal from a tender alongside. Suddenly the ship listed to starboard, and her ports being open, the water poured in so rapidly that she foundered in a few minutes. The hour was early, and nearly all the officers and crew (between 70 and 80 in number) were asleep in their berths. The most of them rushed out half clad, and were picked up by boats from nearby vessels. Two officers and three of the crew were drowned. The vessel sank in about fifty feet of water.

The disaster is attributed to the clumsy and unscientific method of coaling practiced at Sydney. Though favored with one of the finest harbors in the world, with superabundant space available for wharfage, there are no coaling facilities at Sydney for large ocean going steamers. Accordingly such vessels proceed to Neutral Bay, and there at anchor await the coming of lighters.

The coal is emptied into the bunkers on one side until the vessel lists; then the lighters are removed to the opposite side of the vessel. This change was not made soon enough on the morning of the disaster to the Austral. Naturally there is now a loud call in Sydney for coal docks after the fashion of those in use in this country.

A Heavy Brain.

It is well known that, although many distinguished men have had very large brains, these have been occasionally equaled by the brains of persons who never displayed remarkable intellect. Another illustration of this has been lately published in the Cincinnati *Lancet*, by Dr. Halderman, of Columbus. A mulatto named Washington Napper, aged 45 years, recently died in the hospital at that town in consequence of purulent infection due to an abscess of the thigh. His brain was found to weigh 68¾ ounces, nearly 5 ounces more than the famous brain of Cuvier. His height was six feet; his limbs are said to have been ape-like in length, his head was massive, lips thick, lower jaw prominent, but his forehead large and well developed. He had been a slave until the year 1862, and had never been regarded as particularly intelligent; he was illiterate, but is said to have been reserved, meditative, and economical.

India-rubber Ocean Carriers.

A substitute for the time-honored bottle for carrying records of disaster at sea is found in a light rubber ball two or three feet in diameter and brightly painted. It is so light that it is rapidly carried before the wind, and is so conspicuous that it can be seen at a long distance. One of these couriers, having been thrown from a Swedish steamer on her way from London to Gothenburg, was picked up four days afterward on the coast of Schleswig, and another traveled two hundred nautical miles in five days. A number of these couriers, even if thrown overboard in mid-ocean, might bring relief to a disabled steamer by carrying word to passing vessels of the probable position of the disabled ship.

Chlorophyl in Animals.

The occurrence of the green pigment peculiar to plants in certain animals (such as fresh water sponges, polypi, worms, etc.) and its absence from some kinds of plants (fungi, etc.) make it impossible to make use of chlorophyl as a mark of distinction between where the line may be drawn separating the animal and vegetable kingdoms. Dr. R. Brandt has recently published some important investigations upon the chlorophyl of animals. As these experiments lead to some very interesting results, we propose to lay before our readers a brief notice of these points as given in the German *Humboldt:*

That the green pigment in animals is real chlorophyl had already been proven. Thus Max Schultze proved it chemically, while Sorby and Lancaster found that the spectroscopic reactions (absorption bands) of animal and vegetable chlorophyl were the same, and Geddes found that the green substance in some sea animals decomposed carbonic acid and liberated oxygen in sunlight. The corpuscles that contain the green chlorophyl are not parts of vegetables which have been absorbed by the animal; they are all of nearly the same size and shape; they are always found within the animal in considerable quantity, never outside of it.

They never exhibit any considerable change during digestion; no decrease of green particles takes place in isolated chlorophyl-bearing infusoria, which must be the case if they were the result of digestion. In large trumpet-shaped infusoria the green granules lie just under the skin or rind, and not in the inner part where digestion takes place. There are two possible suppositions. Either the chlorophyl particles are integral constituents of the animal organisms in question, or else they are not, and only play the part of parasites or messmates. The latter seems to be correct, for nearly all the animals in question have been observed without this green pigment, and the latter cannot be formed without light, which is known to be the case with plants too, excepting fungi.

Peculiar yellow cells have been observed in the radiolaria and actinea, the parasitic nature of which has been proved by Cienkowsky, Hartwig, and Brandt beyond a doubt. In their occurrence and behavior they have much resemblance to the green granules under discussion. Haeckel and others had already shown that those yellow substances were true cells.

Brandt has now proved that the green substances in animals are of a cellular nature. The true chlorophyl granules in plants are morphologically and physiologically dependent parts of the cells; they have no cell nucleus nor cellular membrane, and if isolated soon swell up and are destroyed. Now Brandt has shown that the green granules in animals (hydra, infusoria, planaria, etc,) always contain some hyaline protoplasm, in which a true cellular nucleus can be detected by the usual tests; in this protoplasm there is frequently a starch granule, evidently a product of the assimilation of the chlorophyl body.

From this we see that the green substance must be considered as consisting of true cells, and as independent organisms agreeing morphologically with unicellular algæ. This was affirmed of spongillia by Noll as long ago as 1870.

From a physiological standpoint, Brandt showed that the green substance in hydræ, infusoria, and spongillia that have been wounded and torn does not die, but remains unaltered for weeks, and under the influence of sunshine can produce starch cells.

G. Kessler succeeded in causing a colorless stentor (*S. cærulens*) to take up and absorb the green pigment taken from a green spongillia, so that it was converted in a few hours into a green stentor. But he did not succeed in converting a gray fresh water polyp (*Hydra grisea*) into a green one (*Hydra viridis*).

Brandt conjectures that both species are identical, but as yet he has no decided grounds for proof. On the other hand, colorless infusoria were changed into green ones by being fed on the green matter from *Hydra viridis*.

Brandt gives to these green substances, considered as one celled algæ, the genus name of "Zoochlorella," and divides them into two species, *conductrix*, living in hydræ, and *parasitica*, living in spongillia.

According to this, chlorophyl should be entirely wanting in the animal organism, and only occur in real plants. The same would apply to the product of assimilation—namely, starch; hence the assimilation by animals and fungi on the one hand would be totally unlike that in plants on the other hand.

The physiological import of these green particles is considered by Brandt in another chapter. Their occurrence in these transparent water animals permits of their performing the normal functions of chlorophyl, the production of organic matter from water and air, with the evolution of oxygen, in the presence of sunlight. The query then arises, Do these algæ produce only just as much matter as they themselves require, or do they give some to their hostess? Brandt answers this in the affirmative, for most green animals seem to take no food at all; in fact, many of them are so full of green stuff that they have no room for food. Green spongillia were fresh and lively after being kept for four months in water that was filtered daily.

In 1876 Geza Entz published some experiments in the Hungarian language, the results being similar.

If further investigations confirm this relation of host and guest, which is very probable, the relation of the algæ with other organisms can be classed under three heads.

1. Algæ and phænogamous plants. The latter fill the place of host, while the former play the part of tenant or guest. Each lives independently of the other, as far as food and nutrition are concerned.

2. Algæ and fungi (lichens). Here the algæ are the hosts which nourish and sustain the parasitic fungi. The algæ are there first; the fungi move in upon them, and cannot live independently.

3. Algæ and animals—the "Phytozoa" of Brandt. Here the animals are host, the algæ the tenants; but the latter sustain and support the former, receiving from them, at most, nothing but carbonic acid. According to Entz, if they are too abundant in the infusoria, they are crowded inward and digested; they pay their rent with their lives.

The New Monitor.

The navy department appears to be well pleased with the behavior of the lately launched monitor Miantonomoh while on her trial trip from Philadelphia to Washington. It is reported that while in the Chesapeake Bay she made ten and one half knots per hour, which is said to be equal to the highest speed ever reached by the best iron-clad of her class. There are two other monitors of the class of the Miantonomoh, exactly alike, which up to the present time have been considered the best that have been launched. They are the Solimoes and the Javary, built at Bordeaux, France, for the Brazilian Government. The Solimoes was launched in 1875, and the Javary in 1881. They are of 3,700 tons displacement, the Miantonomoh being 3,800 tons. Their length of beam and draught measurements are the same as in the case of the American monitor, and like her they are double turreted and low freeboard ships. The Solimoes, on a trial trip in September, 1881, in Brazil, just outside of Rio, developed with half revolutions of the screw a maximum speed of ten and a half knots, the same as the Miantonomoh. It is held as to the credit of the American monitor that, though her screws are smaller than intended, yet she made this speed smoothly and without difficulty, with all weights aboard and floating down to the load line. It is claimed also that the frames of the Miantonomoh are stronger for ramming than those of any monitor of her class constructed up to the present time. The officials of the department profess to be very much pleased with her in every respect, and predict that when properly armed and finished she will be able to cope with any vessel of her size afloat.

Protection against Lightning.

The Pic du Midi Observatory, recently established in the Pyrenees, is of necessity greatly exposed to thunderstorms. In consequence, considerable care has been taken to protect it against the effects of lightning. Two lightning conductors about 8 feet high have been fixed at the two ends of the house, and connected together by an iron armature, as also with all the ironwork of the building, and with thistle headed metallic spikes having six points at the angles of the roof and on the shed. It was found advantageous to make the points truncated cones, instead of sharp, as they are of gold plated copper, with tin junctions. These points remain intact, while sharp ones are damaged. The whole system is connected with two other large conductors, 233 feet apart, on two small eminences a little way from the house, and connected by chains, the one with the Lac d'Ouest, the other with a snowy ravine. The arrangement works perfectly; a hissing sound is often perceptible during thunder storms, and it seems as though the storm is of diminished intensity at that point. It is said that the telegraph clerk at Bagneres, however, has often to use his lightning conductor to avoid being struck. The observatory is situate at between 9,350 and 9,400 feet above the sea (2,877 meters).

Recipe for Luminous Paint.

For making luminous paint the following has been given: Take oyster shells and clean them with warm water; put them into the fire for half an hour; at the end of that time take them out and let them cool. When quite cool pound them fine, and take away any gray parts, as they are of no use. Put the powder in a crucible with alternate layers with flour or sulphur. Put on the lid and cement with sand made into a stiff paste with beer. When dry, put over the fire and bake for an hour. Wait until quite cold before opening the lid. The product ought to be white. You must separate all gray parts, as they are not luminous. Make a sifter in the following manner: Take a pot, put a piece of very fine muslin very loosely across it, tie around with a string, put the powder into the top, and rake about until only the coarse powder remains; open the pot and you will find a very small powder. Mix into it a thin paint with gum water, as two thin applications are better than one thick one. This will give paint that will remain luminous far into the night, provided it is exposed to the light during the day.

Legal Construction of Patents.

In the case of Weir *vs.* the North Chicago Rolling Mill Company, Judge Blodgett, of the United States Circuit Court, Northern District of Illinois, held that a patentee, in reducing his patent to practical application, is not held to strictly and entirely follow the mere mechanical device shown in his drawings, but he may deviate so long as he does not violate the principle involved in his patent.

In the case of Evans *vs.* Kelly, same court, Judge Drummond decided that a patent claim must be construed in the light of the specifications, and where the specifications describe the entire article, parts of the description cannot be separately considered to show an infringement of one of the parts.

Chrome Yellow.

This process is based upon the solubility of metallic citrates in alkaline citrates, and particularly in ammonium citrate. This property applies not merely to the metallic citrates, but to a number of other salts. Thus, in presence of an alkaline citrate baryta is not precipitated by sulphates, nor potassium ferrocyanide by the ferric salts. The insoluble chromates are all more or less dissolved by ammonium citrate, and in general more in heat than in the cold. Zinc chromate, among others, which is little soluble when cold, dissolves with great readiness when heated. Lead chromate, on the other hand, is dissolved with much more difficulty. On submitting to the action of steam a color composed of lead citrate, ammonium citrate, and zinc chromate, a lead chromate yellow is obtained almost as solid as that produced by dyeing. By the action of steam the lead citrate and zinc chromate dissolve in the ammonium citrate, and give by double decomposition zinc citrate and lead chromate, which is fixed upon the fiber. The author exhibited a swatch which had been soaped at a boil for half an hour. It may be foreseen that solid greens may be obtained by adding to the color alizarin blue.—*M. Jaquet.*

Russian Teeth.

From a recent examination by Dr. Franzius of the teeth of 650 soldiers in Russia, it appeared that 258, or nearly 40 per cent, had dental caries. He finds that of all the teeth, the third molar is most often affected; such cases making up one-half of all the cases. The teeth are affected in a certain successive order: first, the lower third molar is attacked, then the upper, then the lower fourth molar, and so on. The incisors and the canine teeth of the lower jaw stand last in the line. The durability of the upper teeth stands to that of the lower as three to two. The teeth in persons of fair complexion and hair are less durable than in those of dark complexion and hair (40 to 37 per cent). Stature has a manifest influence on the durability of the teeth, which increases with decrease of height, and *vice versa*. (Dr. Franzius seeks an explanation of this curious fact in a less perfect outer circulation in tall men than in short men.) The right teeth show a greater vitality than the left. The conditions of the soldier's life do not show any harmful influence on the state of the teeth.

A Gigantic Shark.

A formidable shark was lately captured at St. Paul, in the Island of Reunion. The fishermen had observed it for some time following their boats. It was caught with a baited line, and pulled ashore by fifty men, a slip-knot having been passed round the tail. It proved to be a female shark of the species called *Carcarias prionodon* (having saw-like teeth). It measured exactly 5 meters (about 16 feet 8 inches) in length, and 3·60 meters (12 feet) circumference at the middle. It was stranded at a point were a man would be beyond his depth. Two other small sharks were captured soon after. A considerable crowd came to see the monster, which was exhibited by the fishermen at 10 centimes a head. M. Lantz, director of the museum, was advised of the capture, and has preserved the skin and the skeleton.

A Foundry Filled with Poisonous Vapor.

A singular and remarkable occurrence is reported from the Reading (Pa.) Hardware Company. The foundry windows were tightly closed against the inclement weather without, and about ninety men were at work. Suddenly a large volume of sulphurous gas poured out of the opening in the cupola and flooded the foundry. Ten men became deathly sick, and dropped to the floor at once. The others commenced vomiting, and complained of severe pains in the stomach and the head. Two were perfectly unconscious, and remained in that condition for some time, having to be taken to their homes in carriages. The foundry presented the appearance of a huge hospital, with men lying in every direction. About seventy men were affected, and the foundry was obliged to suspend operations for some days.

The Volta Prize.

The French prize of 50,000 francs instituted by the decree of June 11, 1882, in favor of the author of the discovery which shall enable electricity to be applied economically in one of the following directions: As a source of heat, of light, of chemical action, of mechanical power, as a means of the transmission of intelligence, or of the treatment of disease—will be awarded in December, 1887. The *savants* of all nations will be admitted to compete up to June 30, 1887. A commission nominated by the Minister of Public Instruction will be charged with examining the invention specified by each candidate, and of recognizing whether it fulfills the conditions required.

Estimating the Damages for Patent Infringement.

In the United States Circuit Court, District of Connecticut, Judge Shipman held, in the case of Zane *vs.* Peck, for infringement of a faucet patent, that the measure of damages for infringement of a patent is the profits that the plaintiffs would have made on the sales of the patented article had they supplied the customers to whom the defendants sold such article. In estimating the amount of such profits, the cost of manufacture and sale should be deducted, and on sales of a large amount clerk's hire, storage, freight, etc., should be considered as part of such cost. The motion of plaintiffs for treble damages was denied.

MACHINE FOR SHARPENING TWIST DRILLS.

One of the most recent inventions of the house of Heilmann-Ducommun & Steinlen, of Paris, is a machine for sharpening the end of twist drills of the American type. This machine gives still another proof of how generally this American tool has come into use, inasmuch as for one of the operations which, at first sight, seems one of the simplest, the manufacturers have been led to substitute an apparatus for the hand of man.

The principal part of the machine is a vertical emery wheel, which revolves very rapidly, and to which the horizontally arranged bit to be sharpened presents itself with an obliquity corresponding to the conicalness to be obtained. The sharpening is effected in two periods—that is to say, after half the conical surface is finished the operation is arrested in order to give the drill a half turn, so as to complete the sharpening. During the operation, moreover, and while the emery wheel is describing a constant plane, the drill takes on an oscillatory motion, which corresponds to about a quarter revolution; and, finally, the carrier undergoes a slight horizontal oscillatory motion, from whence it results that the form of the cut is not exactly conical, but assumes a shape slightly like that of an ogive.

We shall now proceed to describe this important tool, which is represented in all its details in the accompanying plate.

Fig. 1 gives a view of the machine, which is partly a perspective one and partly a longitudinally sectional one on the line 1–2, to allow the mechanism to be seen that is contained in the case upon which the tool is mounted. Fig. 2 shows a horizontal projection. Fig. 3 is a transverse section on the line 3–4. Fig. 4 shows, in section and beneath, and on the line 5–7, the case containing the mechanism of the driving gear.

Conformably to the general definition that we have just given, the principal tool of the machine is an emery wheel, A (Fig. 6), mounted on the extremity of an axle, B, that operates like the shaft of a lathe; but, as this axle has to possess the property of an effective longitudinal movement, it is mounted in the interior of a cast iron sleeve, C, which is adjusted, like a carriage support, on a plate, D, upon which it is capable of sliding and carrying along the emery wheel and its entire mechanism.

But, to prevent the emery wheel from always operating with the same part of its surface, the entire part that we have just described is arranged so as to have an automatic transverse movement during the action of the wheel; so this plate, D, upon which the sleeve is mounted after the manner of a carriage, is adjusted in the same way on the support, E, but perpendicularly; and it is then connected with a special mechanism that communicates to the whole that alternating transverse motion which is required for the proper working of the emery wheel.

The support, E, which serves as a base to this part, is fixed upon a cast iron table, F, which covers a case, G (likewise of cast iron), that contains different important parts of the mechanism. It is upon this same table, F, that is mounted the carrier that holds the drill to be sharpened. This carrier, H, consists of a cast iron cylinder connected with the horizontal base plate by a support having an elliptical section.

As the different figures (especially Fig. 2) indicate, the axis of the drill-carrier forms with the plane of the emery wheel an angle which corresponds with that which the sharpened extremity of the drill is to possess. But its position is not absolutely fixed; for, during the work, it must describe a slight angular movement, according to a fixed point as a center situated in a line perpendicular to the extremity of the bit. At this point (see Fig. 5) the base plate, H′, carries a socket which traverses the table, F, and holds a bolt, *a*, on which the base plate turns in its angular movement. The base plate, H′, is beveled off at its opposite extremity, and is adjusted concentrically to the bolt, *a*, in a piece, *b*, which secures regularity in the motion of the drill-carrier and holds it in a vertical direction.

Independently of this general motion of the carrier, which has the effect of giving the cut a somewhat ogive form instead of that of a regular cone, which it would have were the carrier, H, immovable, the bit makes a quarter revolution during the operation, as before stated, so that the emery wheel acts at first on half of the surface to be sharpened, and then, on a half revolution of the drill, completes the operation.

The same mechanism that causes the oscillation of the carrier also effects the rotary oscillation of the bit, through the following arrangement:

The cylinder, H, contains within it a second cylinder, *d*, which is so arranged as to receive the bit and hold it firmly. To the cylinder, *d*, there is affixed a disk, *e*, which is attached to a socket, I, mounted freely on the cylinder, H. This socket, I, is cast in a piece with a toothed sector, which gears with another sector, I′, of the same size, whose axle revolves in a socket, *f*, adjusted in the plate, H′. The axle, *g*, traversing the socket, *f*, carries a pinion, J, which engages with a rack, J′, fixed under the table, F.

The machine is actuated simultaneously by two different belts. The axle, B, of the emery wheel is revolved separately through the medium of a small pulley, B. A second, and narrower belt, running over a fast and a loose pulley, *h* and *h′*, sets in motion an axle, K, revolving in the bearings, F′. This axle, K, carries two endless screws, which are designed to effect respectively a transverse movement of the emery wheel and the combined motions of the bit carrier. There will be remarked in these different figures a rod, *i*. This carries the belt guide for the pulleys, *h* and *h′*. The machine, as a whole, is bolted to a base, G, which is hollow and serves as a tool chest. The emery wheel, A, revolves within a copper jacket, A′, the object of which is to prevent the dust from the wheel becoming disseminated through the air and injuring the workman. It is also provided with a tube, *t*, on which may be adjusted a rubber tubing for carrying off the dust through the draught set up by the revolving wheel. This important accessory is represented in detail and on a larger scale in Figs. 9 to 11.

THE FIRST MOTION OF THE EMERY WHEEL.

The wheel, A, which is represented in detail in Fig. 9, has a wide opening in its center, and is adjusted on the axle, B, by a central screw, *f*. This axle, B, which revolves in the interior of the sleeve, C, is adapted thereto by a conical bearing for the purpose of obviating all longitudinal play. This adjustment, in order to produce all its effect, is finished off at the opposite extremity with a conical ring, which has a thread on its cylindrical part that carries the pulley, B′. As has been seen, this sleeve really forms part of a puppet mounted with slides on the support, D, and this effective movement is given it in order to bring about the approach of the emery wheel and the drill to be sharpened. Such movement is produced, as usual, by means of a screw, *k*, fixed in the puppet, C, and traversing nuts connected with the support, D. This movement and the degree of approximation are limited by the contact screw, *k′* (Fig. 1).

TRANSVERSE MOTION OF THE EMERY WHEEL.

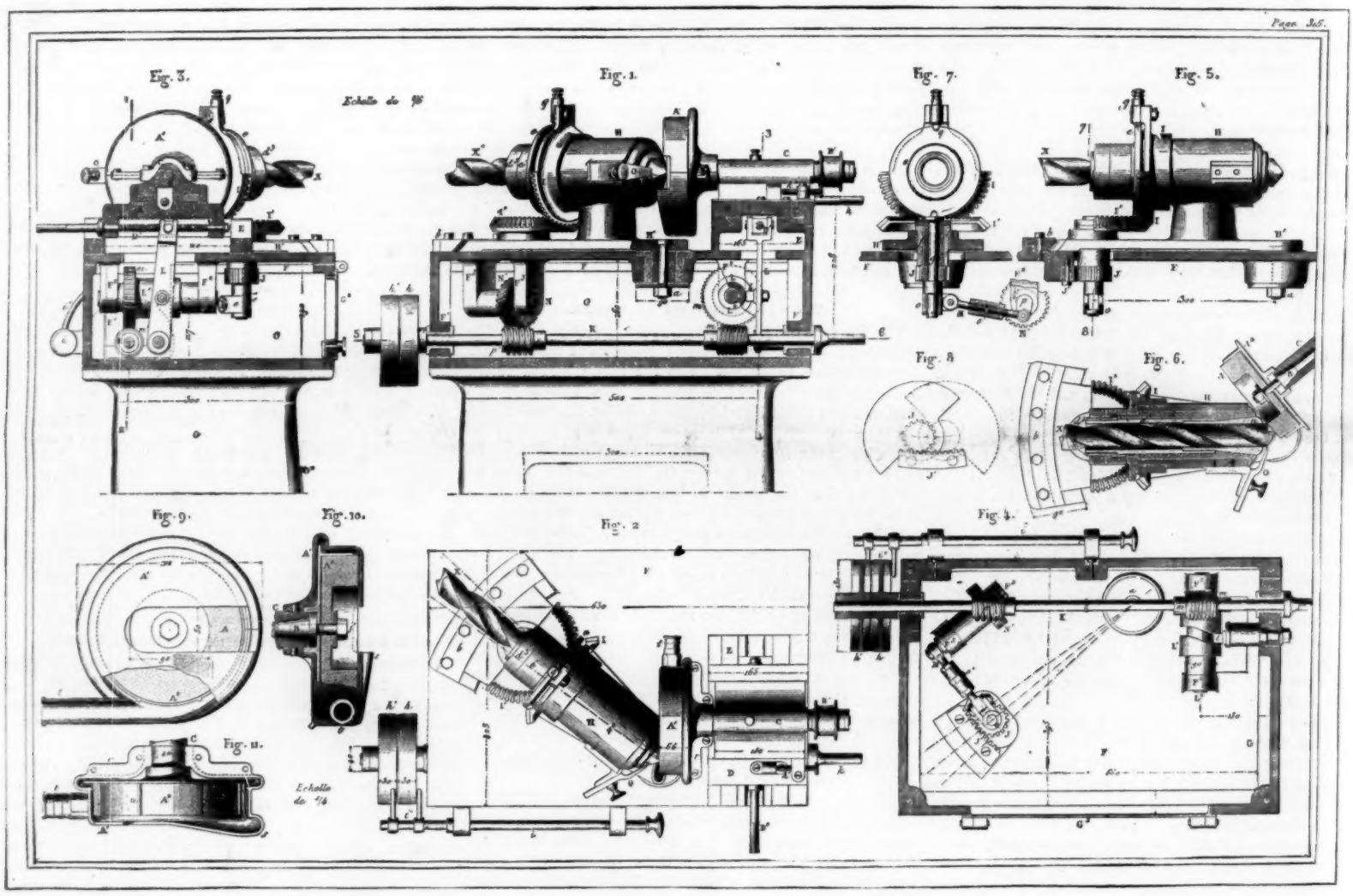
To properly understand this motion, which is much more complicated than the preceding, and which is, moreover, entirely mechanical, it will be necessary to consult Figs. 1 and 3, where it will be seen that the support, D, is traversed by a screw, D′, upon which is mounted a spring block that is embraced by the forked end of a lever, L, oscillating around its lower extremity as a center. The oscillatory motion of this lever is brought about by a cam, I′, containing a screw-shaped groove, into which enters a slide, *l*, belonging to the lever. This cam is mounted upon an axle, L^2, revolving in brackets, F^2, cast in a piece with the table, F, and carrying likewise a helicoidal wheel, *m*. This latter, gearing with an endless screw, *m′*, on the axle, K, it results that the axle, L^2, is submitted to a continuous rotary motion, which, as regards the lever, L, becomes an oscillatory motion that is transmitted to the support, D, and consequently to the emery grinder.

ARRANGEMENT OF THE DRILL-CARRIER.

The arrangement of the interior of the cylinder, H, for fixing therein the drill is somewhat elaborate. It consists of the socket, *d*, which is submitted to the alternating circular motion, and to which is directly affixed the disk, *e*—the latter being held longitudinally by a nut, *e′*. This socket contains within it a second socket, *d′*, which is directly traversed by the drill, and is held in place by a screw collar, d^2, actuated by the ring, d^3. The drill is really held tightly in place by a conical plug screwed into the socket, *d′*. It is evident that the mounting of drills of different diameters is effected by substituting similar pieces of different sizes.

COMBINED MOTIONS OF THE BIT-CARRIER.

It now remains to show how the carrier is actuated. For this purpose we shall refer to Figs. 7 and 8. From these it may be seen that the axle, *g*, carries a socket, *o*, with which is



IMPROVED MACHINE FOR SHARPENING TWIST DRILLS.

articulated a rod, M, consisting really of two threaded rods connected by a nut, *o'*, thus permitting the length of this piece to be regulated with accuracy. This rod articulates at its other extremity with the pin of a very small crank, *p*, belonging to the shaft, N, which revolves in the brackets, F², and which is arranged parallel with the axis of the mean position of the carrier. On the end of this shaft, N, there is fixed a pinion, N', whose teeth engage with an endless screw fixed on the driving shaft, K. It results from this arrangement that the rod, M, communicates to the axle, *g*, an alternating motion, carrying with it the whole mechanism of the carrier, and thus determining its oscillatory motion; but, at the same time, the forced gearing of the pinion, J, with the fixed rack, J', causes the former to make a partial revolution, which it transmits to the socket, *d*, and the drill that it holds. Fig. 8 is a geometrical diagram of this motion, showing the displacement of the pinions on the rack, the angular motion that results therefrom in the carrier, and the extent of its revolution. We have said that the interdependence between the motion of the sector, I', and the socket, *d*, resulted from the connection between the disk, *e*, and the first sector, I. But this disk has still another important function. Its connection with the sector, I, results from a spring nut, *q*, bolted upon a projection belonging to the sector and entering a notch in the circumference of the disk, *e*. As there are, in reality, two like notches, diametrically opposite, this disk thus serves as a divider for changing the position of the drill and presenting the two halves of its extremity to the grinder with precision. Its longitudinal position for the two phases of this operation is likewise secured by means of a sort of alidade, O (Figs. 1 and 2), mounted at the extremity of the carrier, H.—*Machines, Outils et Appareils.*

First Use of Anthracite Coal.

Anthracite coal was discovered in Pennsylvania soon after the settlement of the Wyoming Valley, but its first practical use was by Obediah Grose in his blacksmith shop, in the year 1768. In 1791 Philip Ginter discovered anthracite coal on the Lehigh. In 1802 Robert Morris, of Philadelphia, formed a company and purchased 6,000 acres of the property on which Ginter discovered the coal. The coal company was called the Lehigh Coal Mine. This company opened the mine and found the vein to be 50 feet thick and of the very best quality of coal. The company made every effort to secure a demand for the coal, but without success, and having become thoroughly disgusted with their speculation, leased the 6,000 acres of this mammoth coal field to Messrs. White & Hazard, of Philadelphia, for twenty years, at an annual rental of one ear of corn. Messrs. White & Hazard tried to use the coal in the blast furnace in 1826, but failed; the furnace chilled. In 1832 Neilson conceived the idea of the hot blast for saving fuel, and in 1833 David Thomas adopted the idea of the hot blast and anthracite together. White & Hazard had, previous to this, formed a company and bought the property. In 1839 Thomas made the use of anthracite for making pig metal a success, by which the twenty ears of corn were transferred into $20,000,000. And this is the early history of the great Lehigh coal mines of the present day. I remember well the banquet given by Burd Batterson and Nicholas Biddle at Mount Carbon in 1840, at which time they paid William Lyman, proprietor of the Pioneer Furnace, $5,000, the premium they had offered for the first successful use of anthracite coal as fuel in the blast furnace. But David Thomas was the lion of the day.—*Pittsburg Commercial.*

The Treatment for a Cold.

The *Monthly Magazine* (London) reports Dr. Graham as saying that it is not a correct practice, after a cold is caught, to make the room a person sits in much warmer than usual, to increase the quantity of bed clothes, wrap up in flannel, and drink a large quantity of hot tea, gruel, or other slops, because it will invariably increase the feverishness, and, in the majority of instances, prolong rather than lessen the duration of the cold. It is well known that confining inoculated persons in warm rooms will make their smallpox more violent, by augmenting the general heat and fever; and it is for the same reason that a similar practice in the present complaint is attended with analogous results, a cold being in reality a slight fever. In some parts of England, among the lower order of the people, a large glass of cold spring water, taken on going to bed, is found to be a successful remedy, and in fact many medical practitioners recommend a reduced atmosphere and frequent draughts of cold fluid as the most efficacious remedy for a recent cold, particularly when the patient's habit is full and plethoric.

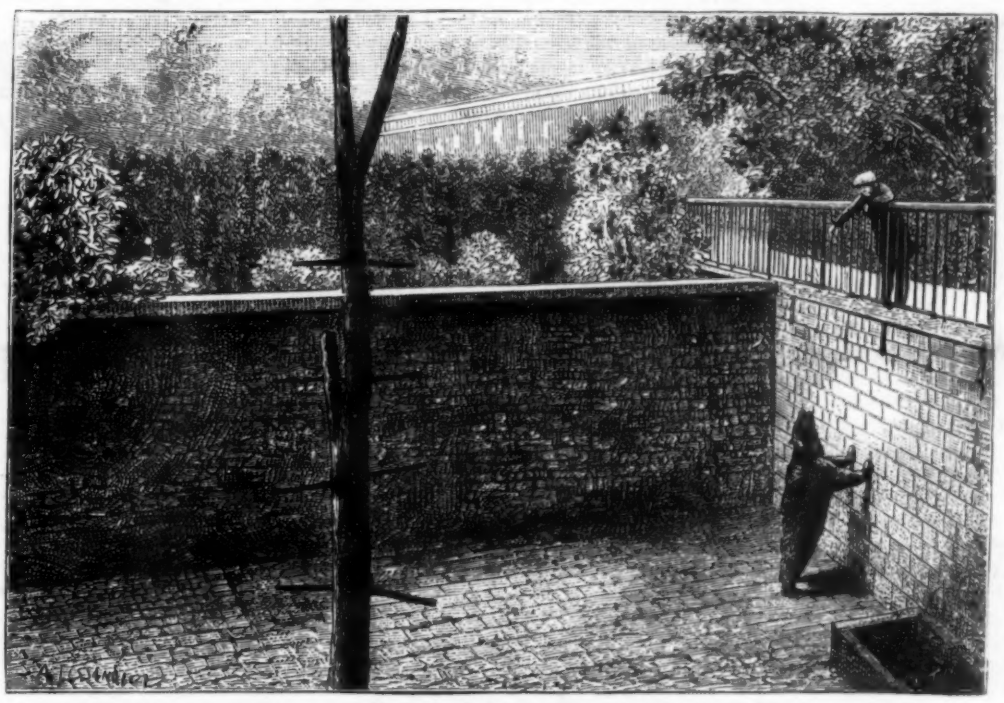
Dr. Graham further says:

It is generally supposed that it is the exposure to a cold or wet atmosphere which produces the effect called cold, whereas it is returning to a warm temperature after exposure which is the real cause of the evil. When a person in the cold weather goes into the open air, every time he draws in his breath the cold air passes through his nostrils and windpipe into the lungs, and, consequently, diminishes the heat of these parts. As long as the person continues in the cold air, he feels no bad effects from it; but as soon as he returns home, he approaches the fire to warm himself, and very often takes some warm and comfortable drink to keep out the cold, as it is said. The inevitable consequence is, that he will find he has taken cold. He feels a shivering which makes him draw nearer the fire, but all to no purpose; the more he tries to heat himself, the more he chills. All the mischief is here caused by the violent action of the heat.

To avoid this when you come out of a very cold atmosphere, you should not at first go into a room that has a fire in it, or if you cannot avoid that, you should keep for a considerable time at as great a distance as possible, and, above all, refrain from taking warm or strong liquors when you are cold. This rule is founded on the same principle as the treatment of any part of the body when frost bitten. If it were brought to the fire it would soon mortify, whereas, if rubbed with snow, no bad consequences follow from it. Hence, if the following rule were strictly observed—when the whole body, or any part of it, is chilled, bring it to its natural feeling and warmth by degrees—the frequent colds we experience in winter would in a great measure be prevented.

THE JARDIN DES PLANTES REPRODUCED BY PHOTOGRAPHY.

Photography is rendering incomparable services to all the sciences. Astronomy, physics, and chemistry are drawing on its resources every day to fix on the negative stars, luminous spectra, or microscopic objects. This art, so valuable, is likewise called upon to lend its useful aid to the natural sciences. Such a reflection recently arose in our mind on examining a remarkable photographic collection due to the talent of M. Pierre Petit. This collection includes more than two hundred photographs of large size, representing the entire Museum of Natural History of Paris. On looking over the album containing these photographs, we see reproduced with genuine art the hothouses, the gardens, the menagerie, the collections, the mounted animals, and even the living ones, taken at a flash by instantaneous photography in the posture peculiar to them. The annexed engraving was taken from one of these photographs representing a bear pit. The bear, "Martin," is seen standing upright at the moment at which the traditional piece of bread is about to fall from the hand of a visitor. This scene, as may be observed, is perfectly truthful, and forms a charming picture.



BEAR PIT IN THE JARDIN DES PLANTES.—FROM AN INSTANTANEOUS PHOTOGRAPH.

As well known, these bear pits are three in number—one for the white bears and the others for the brown ones. It was in one of these pits that was formerly kept the genuine "Martin," so celebrated throughout Paris for his size, beauty, and agility in climbing the tree planted in the middle of his pen, and especially for having hugged to death an old soldier who, having at night mistaken a metal button for a five franc piece, had the imprudence to enter the pit to get it. This celebrated bear no longer exists, but he has successors, and the visitors always see one "Martin," in the Jardin des Plantes.

The collection of photographs that we have looked over is so interesting that we should like to be able to reproduce the whole of it. We have especially admired some photographs of the hothouses, and those of the reptile menagerie. The reproductions of the cases of insects and butterflies of the entomological collection are astonishing for their accuracy and sharpness; and they do the greatest credit to the talent of the operator, and will, we believe, render true services to naturalists.—*La Nature.*

Garnets.

The color of the garnet is blood or cherry red; when mixed with blue it passes into crimson and violet red, and when tinged with yellow into hyacinth red; it is also met with of a reddish brown color, liver-brown, and black, also greenish black. It occurs in mass, disseminated, in angular fragments, or crystallized. Its primitive figure is the rhomboidal dodecahedron, which, when somewhat lengthened, presents the appearance of a short six-sided prism, the faces of which are parallelograms terminated by trihedral summits with rhomboidal faces. Sometimes the original faces of the dodecahedron entirely disappear, and the result is a solid bounded by 24 equal and similar trapeziums. Sometimes all the sides of the primitive dodecahedron are replaced by lengthened hexagons, whence results a solid bounded by 12 rhombs and 24 hexagons. Other more complicated figures, but which cannot be rendered intelligible by mere description, originate from the mixture of the two preceding modifications. The size of the crystals is subject to great variations. Some are no larger than a pin's head, while others are four inches or more in diameter. The external luster is casual, but generally glistening; the internal luster is bright-shining, vitreous. Its fracture is perfectly conchoidal, passing into imperfectly conchoidal, coarse grained, uneven, or splintery. Its fragments are indeterminately angular and sharp edged. In sometimes occurs in granular or lamellar distinct concretions. It varies from transparent to translucent on the edges. Its hardness is superior to that of quartz. Its specific gravity is from 3·7 to 4·2.

It is often magnetic, and is fusible without much difficulty before the blowpipe into a black enamel. When strongly heated in a charcoal crucible, it affords a gray dusky glass full of grains of iron, often amounting to 10 or 12 per cent.

This mineral has been repeatedly analyzed by Klaproth, Vauquelin, and other able chemists, but without much agreement in the results; and as in general the same method of analysis has been adopted, the remarkable differences which have occurred can only be attributed to a real variation in its composition; they all agree, however, that it contains a large proportion of iron, and possibly this ingredient may be the one which principally influences its crystallization.

The Bohemian garnet has been analyzed by Klaproth, with the following results: Oxide of iron, 16·5; oxide of manganese, 0·25; silex, 40; alumina, 2·85; lime, 3·5; and magnesia, 10. Vauquelin's analysis of the same stone gives the following: Oxide of iron, 41; silex, 36; alumina, 22; and lime, 3. The Sirian garnet, according to Klaproth, contains: Oxide of iron, 36; oxide of manganese, 0·25; silex, 35·75; and alumina, 27·25. The most beautiful and valuable garnets are the oriental. They come principally from Pegu; and the town of Sirian having been formerly the chief mart for them, they are hence by corruption known among lapidaries by the appellation of Sirian garnets. They appear to be the carbuncle of the ancients; their color is crimson, verging into a very red violet; they are transparent, and have a conchoidal fracture. Of their geological situation we are entirely ignorant.

Next in estimation to the oriental is the Bohemian garnet. It is met with in the Mittelgebirge of Bohemia and in Saxony; its color is blood red, verging into yellow; it never occurs crystallized, but only in rounded and angular grains; it is transparent, and its fracture is conchoidal. It occurs in floetz-trap and in alluvial land, formed by the decomposition of this class of mountains; it is also met with in serpentine.

Common garnet occurs almost always in primitive rock, especially in micaceous schistus, chloritic slate, and serpentine; it is sometimes so abundant as to constitute the principal part of the rocky mass in which it is found, which is then an excellent flux for iron ores on account of its fusibility and the large quantity of this metal which it contains.

The oriental and Bohemian garnets when cut and polished are very beautiful, and were formerly (particularly the first) in high estimation, but by the caprice of fashion their employment, and consequently their value, have since much declined.—*Glassware Reporter.*

THE new elevator just erected in Detroit is one of the largest in the country. It is of brick, is 311 feet long, 93 feet wide, and 136 feet high. It has a capacity of 1,300,000 bushels. The belting is of rubber. The main belt is 48 inches wide. The elevator bucket belts are 20 inches wide. The machinery, it is said, has a capacity to handle in ten hours all the grain the elevator can store.

PHOTOGRAPHIC NOTES.

IMPROVED DEVELOPERS.

Stock Solution No. 1, which will keep:

Water.....10 ounces.
Saturated solution of *free* bromine in water.....60 minims.

The bromine solution is first mixed with the water, and then

Pyrogallic acid.....120 grains

is added. The solution is now ready for use. Care should be taken to avoid inhaling the fumes of bromine when mixing it with water.

Stock Solution No. 2.

Water.....2 ounces.
Liquor ammonia, 880°.....1 ounce.
Bromide of potassium.....180 grains.

This solution must be kept in a tightly corked bottle.

Stock Solution No. 3.

Water.....20 ounces.
Stock solution No. 2.....3 drachms.

To develop a quarter plate take seven drachms of No. 3, to which add sixty minims of No. 1; flow this over the plate; and the image will develop gradually free from fog. A. L. Henderson, of London, England, originator of a new formula for cold gelatine emulsification, regards the above developer as superior to all others for gelatine plates.

A modification of the above developer has been found to work well.

Two stock solutions, one a saturated solution of washing or sal soda, and the other a saturated solution of pure sulphite of soda in water, should be made.

To develop a 4 x 5 plate, take:

Water.....1 ounce.

to which add

Saturated solution sal soda.....1 drachm.
" " sulphite soda.....1 drachm.
Bromo pyro solution No. 1 (as above).....4 drachms.

Flow and develop in the usual manner.

The formula may be simplified as follows:

Stock Solution.

Water.....32 ounces.
Saturated solution sal soda.....4 ounces.
" " sulphite soda.....4 ounces.

To develop a 4 x 5 plate, take ten drachms of the above, to which add four drachms of the bromo pyro solution No. 1 (as given above).

If the plate has been under-exposed, more saturated sal soda solution should be added; if over-exposed, the developer should be immediately poured off into a measure, the plate flooded with water, then drained, and the developer returned, diluted slightly with water, and a few drops of a 10 per cent solution of bromide of ammonium added. The image will then develop out more slowly, and gain the desired intensity.

Plates developed with this developer are soft, quick printing, clear in the shadows, and possess every good quality of a wet plate.

The employment of sal soda as a developing agent has the advantage over ammonia in that it is more stable. The solution keeps clear but red, and from three to four plates can be developed one after the other at one time.

A GOOD INTENSIFIER FOR GELATINE PLATES.

Solution No. 1.

Water.....8 ounces.
Saturated solution bichloride of mercury.....1 ounce.
Saturated solution bromide of potassium.....1 ounce.

Solution No. 2.

Water.....8 ounces.
Nitrate of silver.....75 grains.
Cyanide of potassium, C. P.....75 grains.

To make No. 2, divide the water into two parts, dissolving the silver in one, and the cyanide of potassium in the other. Then pour the potassium solution into the silver; a precipitate of cyanide of silver will be formed, which will be mostly redissolved by agitation; a slight excess should remain at the bottom of the bottle.

After the plate has been fixed and thoroughly washed, immerse it in the mercury solution; the length of time depends upon the amount of intensity required. If great intensity is desired, let the plate remain until the surface has bleached white. Then wash the plate thoroughly under the tap and immerse in solution No. 2 until the white tint is changed to a deep violet black, which occurs very rapidly. If the plate is left too long in the cyanide solution, the density of the negative is weakened. The trays holding the solution should be rocked to and fro to insure uniform action on the plate.

When the proper time for removal has arrived, wash the plate thoroughly and dry. Among the advantages of this intensifier are that it works quick, gives clear shadows (valuable in line work), and an unequaled brilliancy of color to the negatives.

The Greely Colony Relief Party.

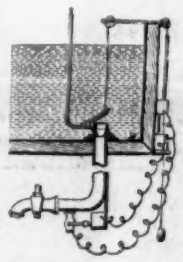
It will be remembered that the party sent to Greenland last summer to carry supplies to the party of observation stationed at Lady Franklin Bay returned without accomplishing their purpose, turned back by impassable fields of ice. As the colony was provisioned for two years only, it becomes imperative that relief shall be got there before the end of the current year.

The selection of the members of the new relief party devolves upon General Terry, of the Department of Dakota. From a list of 200 volunteers or more, there has been selected a detail of one commissioned officer and four enlisted men whose long service in the Northwest has inured them to hardships of the sort to be encountered in their Arctic quest.

First Lieut. Ernest A. Garlington, Seventh Cavalry, who has been selected to command the expedition, was born in South Carolina, and graduated from the Military Academy in 1876. The others of the detail are Sergt. John Kenny, Troop I, Seventh Cavalry; Corp. Frank Elwell, Company E, Third Infantry; O. F. Morits, Company A, Seventeenth Infantry; and Private J. J. Murphy, Company F, Eleventh Infantry. Three of these have been chosen with special reference to their physical qualifications. Lieut. Garlington is less than 30 years old, above the average height, with a strong, well built, soldierly physique. He is intelligent and possesses more than ordinary quickness and energy. He is considered by all who know him to be especially adapted for such a command. In addition to Lieut. Garlington and the men mentioned above, four others have been selected, and with two men from the Signal Corps and a medical officer, will comprise the party. It is proposed that the expedition shall leave St. John, Newfoundland, about June 15 next, so as to take advantage of all favorable conditions of ice, and if possible, reach Discovery Harbor. Should this not be possible the vessel will land the party and stores at Life Boat Cove and return southward. The party will then establish itself for the winter, and endeavor to open communication with Lieut. Greely by sledges and assist him in his retreat from Lady Franklin Bay, if such retreat should be necessary. The desire is to maintain the station at Lady Franklin Bay at least until 1884, in order to realize the full purpose for which it was established.

Preventing Water Pipes from Bursting in Frosty Weather.

A simple method of preventing the bursting of water pipes during frosty weather has recently been patented by Drs Buxton and Ross, and was exhibited at the late Electrical Exhibition at the Crystal Palace. A valve of special construction, called by the inventors a ventilating valve, is screwed or soldered into the end of the house main service-pipe in the cistern, and a piece of string or wire conducted from it to any convenient spot, and fastened to a nail or hook. When frost is expected, all that is needful is to unhook the spring, when the valve falls upon its seat, and air being admitted through the small pipe which rises above the surface of the water, the pipes can be emptied by simply turning on the tap at the lowest point in the house service, the water in the cistern being saved. To obviate forgetfulness on the part of servants, the inventors have called in electricity to their aid. A thermometer of special construction is so arranged that when the temperature falls below 33°, a current is sent through an electro-magnet, which releases a catch, causing the valve to fall upon its seat, and at the same time opening a small pet cock at the lowest point in the house service and draining the pipe. The battery is cut out by the fall of the catch, and when the valve is raised again, that water may flow into the pipes, the connection is made good. The electrical part of the apparatus is by no means an *essential* feature, but simply saves trouble, and prevents the possibility of allowing the pipes to remain full during frost, as the contrivance is rendered automatic by its agency.—*The Building News.*



How Divers Work under Water.

The submarine work of the new Folkestone pier, Eng., is executed by two divers, who, in reply to the questions of the reporter of the *Engineer*, have given the following particulars as to their experiences: "On first beginning to work as divers we felt as if our heads were stopped up; the pressure was felt chiefly in the ears. The increase of depth of water when we are descending is perceptibly felt; the difference of level between high and low water is clearly appreciable. Eight or ten fathoms—48 feet or 60 feet—is a reasonable depth to work in; divers are said to have gone down 220 feet; if so, we should not like to do it ourselves. At 10 feet depth we feel the pressure, and at 20 feet can feel the increase, but do not feel quick or slow variations of but 4 feet or 5 feet. In deep water we feel the pressure all over the outside of the body, and some divers are said to have borne a pressure of 18 pounds or 20 pounds to the square inch. At the present extension of the Folkestone pier we are working at a depth of six or seven fathoms at high water. We then feel the pressure on the outside of the body a little, but not enough to hinder us in our work. When working in shallow water, there is not so much pressure in a diving dress as in a diving bell, because we can regulate the pressure better inside the dress by turning the tap so as to give a larger orifice for the escape of the air. We cannot see far through the glass of the helmet; when the water is exceptionally clear we can see about 20 feet, but usually cannot see beyond 5 feet or 6 feet. Fishes sometimes come to look at us, and mostly from above our heads, because we stir up the bottom, and where the water above is rather clearer they wait on the lookout for any food they can get. If we lift a hand toward them, they are off like a shot. Flat fish near the ground are too quick when we try to catch them with the hand, but we can spear them sometimes with our crowbar. We have never seen any large fish near; the largest which one of us ever saw was a conger eel, about 2 feet 6 inches, which came near about a week ago. He came alongside quietly, and when the crowbar was raised toward him he was off.

"In laying the foundations of the present pier we first level the sea bed; sometimes it is pretty flat, and sometimes we have to dig away 1½ feet or 2 feet. The concrete is slightly damped right through, not much, before it is sent down to us in bags by means of the crane overhead; some of the bags contain 2 cwt. We lay the concrete, bags and all, and the average thickness of the concrete along the bottom is about 15 inches. Only one of us works at a time. When the concrete is laid, the blocks of artificial stone are slowly lowered down to us, and we guide each one into its place; this is all the more easily done because they weigh so much less in water than in air. They are not cemented together beneath the water. They are not always permanently placed at the first attempt; perhaps the bed is not at the right level, so that the block has to be raised again while we level it. We then take the wooden plugs out of the lewis holes of the block, and twist the lewis round with a spanner; when the lewis is thus freed, it is drawn up by the crane. The bottom block may take ten minutes or more to fix, and in exceptional cases as much as an hour. The blocks in the second tier are all placed in ten minutes, including the freeing of the lewis, their bed being necessarily all right. Currents retard the operations.

"When the weather is rough, we cannot work at all, neither can we work at the time of high spring tide, even when the water is smooth, the current being too strong. During the summer we have been able to work here about three days a week. We have a dressing room, and when in full costume out of water are a source of attraction to the small boys of Folkestone, who follow us from the dressing room as far as they are allowed to go along the pier; they do not throw stones. Inside the dresses we cannot hear their remarks unless they shout.

"One of us, W. Chadwick, has been a diver eleven years, and has not had a day's illness all the time. The other of us, Edward Brice, has been a diver seventeen years, and has sometimes had a little touch of rheumatism. Some men are better fitted for diving than others. Some begin to bleed at the ears at once at the depth we now work in. Several men now on these works have had a try at our duties, but gave up because they could not stand the pressure.

"While we are at work a rope with a weight of one cwt. at the bottom hangs down alongside one of the nearest piles, and in descending from the surface we go down it hand over hand; this is easy, because our bodies are lighter in water. Two men are always above us in a boat, one to hold the *air* pipe connecting the helmet with the air pump on the pier, and the other holds the life line, by which we give signals from below. We give the signals in pulls, and they consist of from one to seven pulls. One pull means 'lower block;' two, 'stop lowering;' three, 'heave up;' four, 'turn to the east;' five, 'turn the crane to the west;' six, 'run landward;' seven, 'run seaward.' Sometimes we pull the air pipe, one pull for more air, two for less. If we shake the pipe and then give four sharp pulls, it means 'hung up,' or in other words, entangled so that we cannot get free without assistance.

"We work with Siebe & Gorman's apparatus. The pressure of the air is indicated to the men at the pump by a Bourdon gauge. The heat is great inside the dresses while we are working; much hotter than when we are at hard work on land. We are occasionally under water 3½ hours at a stretch, but the average time is about two hours; then we feel as if we want fresh air and something to drink. In spite of the air supply from the pump, that inside the diving dress acquires the smell of perspiration, and makes us feel faint. For efficient regular work, the depth of water should not be more than twelve or thirteen fathoms. A case occurred once of a diver dying from the pressure being too great at a considerable depth."

Reputation of American Engineers.

Last year, Mr. Baker, one of the foremost English engineers, designed a bridge of exceptional magnitude, it having two spans of 1,700 feet each, or 100 feet more than the span of the Brooklyn Bridge. Mr. Baker's plan was criticised by the Astronomer Royal, Sir George Airey. In his reply, after demonstrating the error of the Astronomer Royal's objections to the strength of the proposed bridge, Mr. Baker says:

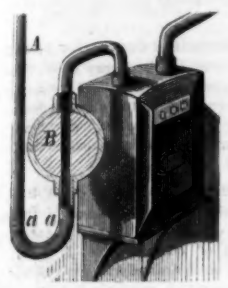
"As a sample of foreign opinion, I would quote that of Mr. T. C. Clarke, the eminent American engineer and contractor, who has built more big bridges himself than are to be found in the whole of this country, and who has just completed a viaduct 301 ft. in height, by far the tallest in the world. Referring to the proposed bridge, he writes: 'If my opinion is of any value, I wish to say that a more thoroughly practical and well considered design I have never seen.' I need hardly say that the opinion of such a man has far more weight than that of an army of amateurs."

Recalling the circumstance that only twenty years ago the New York, New Haven, and Hartford Railroad Company refused to adopt the plans of its engineer for an iron bridge over the Connecticut, until he had taken them to England and had them approved by English experts, the *Railroad Gazette* finds in Mr. Baker's testimony a good illustration of the growth in reputation of American engineers.

RECENT INVENTIONS.

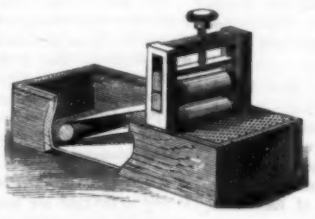
Gas Cut-off.

In a recent article on gas meters as helps to fires, we suggested that there was a field for a practicable invention for preventing the escape of gas following the destruction of the meter or the melting of the connection. Our suggestion has been heeded by Mr. Fred R. Hoard, of Providence, R. I., who has invented the simple and effective device shown in the engraving. It consists of a hollow ball, B, filled with lead or fusible metal with the exception of a central passage. This ball is inserted in the service pipe, A, the latter being bent in U-form. When a fire occurs, the metal in the ball is melted and drops into the lower part of the U, filling it to the line, *a a*, effectually shutting off the gas.



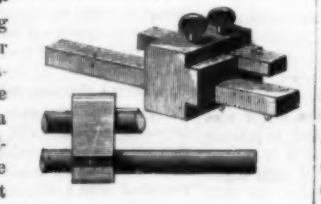
New Washing Machine.

The engraving shows a combined washing and wringing machine lately patented by Messrs. W. W. Adams and D. R. Snelling, of Ozark, Ark. The tub is provided with a roller near its bottom, and standards are secured to its sides supporting an adjustable spring pressed roller bearing on a roller arranged above the top of the tub, and carrying an inclined endless belt provided with a belt fastener, and fastening cords for the clothes. This endless belt passes around the lower rollers while washing, and is wound around the upper of the two lower rollers while wringing them, so that the clothes are washed and wrung without removing them from the belt or withdrawing the water from the tub. The operation is as follows: The clothes, preparatory to being washed, are to be laid on the belt in a spread out condition, and the fastening cords are to be tied over them until the whole length of the belt is loaded. The rollers are then worked by the crank to run the clothes around between them as long as is needed to wash the clothes. After washing the clothes, the belt is taken off from the lower roller by loosening the belt fastening. It is then wound tightly upon the lower of the upper pair of rollers. Another soft cloth is similarly rolled on, and in this condition the two rollers are used for wringing the clothes. A perforated board or screen is placed across the end of the tub in wringing, to prevent the wrung clothes from falling back into the tub. This machine is exceedingly simple, cheap, and easily operated.



Improved Gauge.

The engraving shows an improvement in that class of gauges which are more especially used for gauging door-jambs and the edges of doors for the proper setting of the door hinges, for hanging the door, and for cutting the door and jamb the depth that it is necessary to remove the wood to set the leaves of the hinges flush with the edge of the door and the face of the jamb; and it consists of a suitable stock provided with two marking points or blades (one longer than the other) to be used in combination with a slotted headblock adapted to slide on the stock, the headblock having two gauge surfaces or faces at right angles to the stock, which are the same distance apart as the marking points or blades. The headblock is provided with the usual gauge bar to be used for ordinary purposes. The stock is provided with two marking points or blades, the inner one being of considerable length, and in the headblock is formed a slot, which admits of sliding the block upon the stock past the long point or blade. The distance between the opposite surfaces of the headblock being exactly equal to the distance between the long and short marking points, it will be seen that when the front surface or that next the short marking point is moved to and from the point, the opposite or back surface will be moved an equal distance toward or from the long point. In using this gauge for hanging doors, or for marking or cutting the jamb, the back face of the headblock will be placed against the jamb, and the mark or cut made by the long point or blade. For marking or cutting the edge of the door, the gauge will be applied to the door, the front face being placed against that side of the door the corner of which shuts against the jamb, and the mark or cut made by the short point or blade. By this means it will be seen that the distance from the jamb to the mark made on the jamb will be exactly equal to the distance between the mark on the edge of the door, and the side of the door which comes against the jamb, so that when the door is hung, the side of the door will come properly against the jamb. This invention has been patented by Mr. William McCullough, 454 West Forty-third Street, New York city.

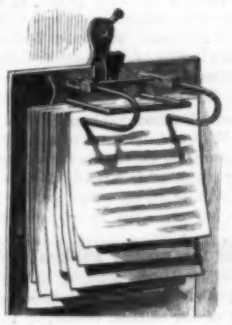


New Paper Holder.

The annexed engraving shows a novel paper holder recently patented by Mr. Ross White, of No. 1 Reade Street, New York city. This device, which is simple and cheap, is designed as a package for containing closet paper. The sheets of paper are removed through the central aperture, and as the surface of only one sheet can be touched, only one sheet will be removed at a time. The package is inexpensively but neatly made, and while it keeps the entire package in good and convenient shape, and permits of the removal of as many sheets as desired, the paper cannot be wasted in quantities, as is commonly the case when the package is suspended by a wire loop. The packages are provided with a suspending loop for receiving the hook.

New Letter and Bill File.

This a file for receiving letters, bills, and similar papers in a manner to allowing convenient inspection of any bill or letter on the file; and further, combined with the file, there is a device for fastening the bundle of bills or letters on its removal. The base plate is formed of metal, and attached permanently to a board, and to it are fixed posts receiving in slots a cross rod, the ends of which are bent up to form hooks, these hooks being tubular. The perforators, which are tubular, are pointed at their outer ends, and screwed into hollow slotted studs on the plate. A guide wire secured to the plate serves as a guide for placing the letters on the perforators. The crossbar carrying the hooks fits loosely in the slots of the posts, so that it is free to be moved up and down, and when in the downward position the hollow ends of the hooks receive the pointed ends of the perforators, so that the perforators and hooks form a continuous wire, and allow the letters to be turned over for the inspection of any one on the file. When the hook bar is raised, the hooks are carried above the ends of the perforators, and may be then turned backward out of the way, to allow the removal or placing of the letters upon the perforators. A handle on the hook bar is used in manipulating it, and a plate spring presses against a projection on the bar, so as to hold the hooks in any position in which they may be placed. The base plate is slotted beneath the hollow studs, to receive the heads of fasteners. The studs are also slotted on one side, to admit of removing the fasteners. These fasteners are ordinary paper clamps, of suitable length, and their folded ends extend upward into the hollow perforators. When the file is filled, the bar and hooks are raised and turned back, the perforators are then unscrewed from the studs, and drawn out, leaving the fasteners in the bills or letters. The ends of the fasteners may then be turned down, and the bundle of papers thus fastened can be removed by sliding the heads of the fasteners from the slots in the base plate. This invention has been patented by Mr. Frank D. Adams, of Auburn, Cal.



General Paralysis.

Dr. Philip Tenner, in the Cincinnati *Lancet and Clinic*, defines the disease as an affection of the anterior portion of the cerebrum, of that part which the study of comparative anatomy and anthropology indicates to be the seat of intelligence, and which modern experimental investigations indicate to contain the motor centers. The pathological anatomy consists of changes in the membranes of the brain, usually most marked in the anterior portions, as well as changes in the cortex and subcortical regions, affecting chiefly the anterior cerebral convolutions. Its earlier symptoms consist chiefly of morbid manifestations of intelligence, such as want of judgment, loss of memory, boastfulness, etc., and of failure of the motor functions occurring simultaneously and progressing correlatively with the mental disturbances.

Remedy for Hog Disease.

A disease of pigs, known in France as *rouget* or *mal rouge* (red evil), has of late wrought terrible ravages in the Rhone Valley, 20,000 pigs having succumbed in a year. M. Pasteur has detected the microbe to which the disease is due. It is somewhat like that of chicken cholera, but much smaller and different in physiological properties. Its form is that of the figure 8. It has no action on fowls, but rapidly kills rabbits and sheep. Injected in almost inappreciable quantity into pigs, it suffices to cause mortal disease. M. Pasteur has succeeded in producing an attenuated form of this virus, wherewith healthy pigs may be vaccinated and rendered refractory to the contagion.

AMERICAN CIVIL ENGINEERS.

The annual meeting of the American Society of Civil Engineers was begun in this city January 17, with many members in attendance.

The election of the following officers was announced: Charles Paine, president; W. H. Paine and Henry Flad, vice-presidents; John Bogart, secretary and librarian; J. James R. Croes, treasurer; and G. S. Green, Jr., J. P. Davis, William Metcalf, W. E. Merrill, and W. G. Hamilton, directors. The special committee on a uniform system of tests of cements, and on the preservation of timber, reported progress and were continued. The special committee on uniform standard time made a report approving the action of Congress in authorizing the President to call an international congress to consider the subject, and recommended the calling of a convention as soon as possible to determine upon a standard of time that would be the best for the interests of North America.

The "Norman" medal for the last year was awarded to A. Fteley and F. P. Stearns, of Boston, for a joint paper upon "The Flow of the Water of Sudbury River." A paper by William P. Shinn, on "Increased Efficiency of Railways for the Transportation of Freight," which was read before the society recently, was discussed.

Mr. Jervis thought that improvement in rails and in road-bed must go together. The weight a steel rail could carry depended largely upon the quality of the road-bed. He spoke of the advances that had been made in using to better advantage the adhesion of the locomotive wheels to rails, and cited as a proof of the improved efficiency of railroad transportation the gradual reduction in canal tolls that had taken place till the waterways of New York had been made free.

Mr. Paine in his paper discussed mainly the detention of cars at stations and sidings. He thought that an assessment of 20 cents a day for the detention of a car would do much to do away with the evil. He admitted, however, that the habits of business men would be against paying such an assessment, and that there were many other obstacles to carrying out the plan, several of which he discussed.

Mr. Emery thought that engineers could be instructed to advantage, so that they could get through many tight places by relying upon adhesion of the wheels and a steady pressure from the boiler.

Mr. Fisher, who is chief engineer of the New York Central Railroad, described a reduction of grade on both sides of the Rochester station, by which $70,000 a year was saved to the company. Mr. Chanute, the chief engineer of the Erie Railroad, said that the practice of that road showed that consolidation engines and long trains were more economical than short trains and the old engines. They had increased the average number of cars in a train from twenty-three to thirty-eight. Instead of increasing accidents by the breaking of trains, such accidents had actually been decreased by strengthening the connections of the cars.

W. P. Shinn, whose paper was being considered, thought that the commercial departments of railroads made a serious mistake in placing those who had come up through the office as clerks in the management. The commercial departments thought only of securing an increase in freight, and so in gross earnings. They should remember that the railroads really wanted net earnings, and not gross. The discussion was postponed, and it was decided to invite railroad managers to take part in it.

The programme for the next day included visits to the East River Bridge, the Erie Basin, the works of the New York Steam Heating Company, and the Mills building, with a concluding reception in the evening.

Breathe through the Nose.

Dr. Ward, Physician to the Metropolitan Throat Hospital, in an article on singers' throat troubles, in the *Musical Critic*, treats of the various kinds of catarrhal troubles experienced by public singers, and repeats the well known fact that the nose is the only channel through which air should pass during ordinary acts of breathing, the mouth being intended only as an accessory breathing agent when, on certain occasions—as, for instance, running—the lungs demand a rapid supply of air. The air, in passing through the nostrils, is warmed and sifted of its harmful ingredients, and thus prepared for its reception into the delicate structures below. If it passes directly into the mouth without the above preparation, it will frequently cause irritation and inflammation of the mucous membrane lining the mouth and throat by being, in the first place, too cold, and in the second place by containing irritating particles of dust and other matter.

The Pioneer White-Lead Maker in the United States.

Referring to a recent article on lead pigments printed in this paper, Messrs. Wetherill & Brother, of Philadelphia, write that priority in the manufacture of white lead in this country is due to their predecessors, Samuel Wetherill & Son, who erected the first white lead works at Broad and Chestnut Sts. Philadelphia, in 1804. Samuel Wetherill was originally a manufacturer of cloths, and has been credited with being the maker of the first cloth made in this country. His importations of dye stuffs led naturally to the importation of pigments, and subsequently, in 1777, to the manufacture of paints. The existing firm is of the fourth generation from the founder of their house, and their books, running back to the year 1777, furnish, they believe, the longest consecutive record of any one established in this country.

ENGINEERING INVENTIONS.

An improvement upon a slide valve shown in Letters Patent No. 250,176, and granted to William B. Turman, of Waldron, Ark., upon November 29, 1881, has been patented by same inventor, and relates to the packing of the valve and the arrangement of the steam ports.

Mr. John T. Davis, of New York city, has patented some valuable improvements upon that class of rotary engines in which a disk provided with valves or pistons that are fitted for transverse movement is combined with a case, the sides of which are formed with one or more helicoidal planes, in contact with which the pistons move, so as to form steam chambers of gradually increasing and decreasing area.

Another improvement in rotary engines has has been patented by Mr. Davis. It is constructed with four laterally swinging valves pivoted in as many chambers in a piston wheel capable of turning between the flat sides of the steam cylinder. Steam is admitted alternately on opposite sides of the valves, and the steam admitted upon one side, after doing its work, acts as a cushion for the valve, preventing it from being drawn forcibly against the side of the cylinder.

An invention designed to transmit power by compressed air or other fluids in a manner to insure the greatest economy of initial power and to overcome the disadvantages heretofore experienced in using compressed air, has been patented by Mr. Alfred D. F. Farley, of Leavenworth, Kan. In this improved apparatus the fluid has continuous circuit, first from the compressor to the distant engine, and from thence back to the compressor.

An improvement in lubricators has been patented by Mr. Peter Barclay, of East Boston, Mass. The invention consists in delivering the oil from a cup or reservoir through a fluid of greater specific gravity than water, preferably an acidulous one, within a glass or glazed chamber, and discharging the same through a suitable outlet, whereby the transparency of the glass chamber is preserved and other advantages are obtained.

An improved steam pump has been patented by Mr. William Hopkins, of Dubuque, Iowa. The invention consists in construction of parts by which the pumps will operate alternately to draw the feed water in at the suction pipe and through the suction chamber, and by their return strokes the water will be forced into the discharge chamber and to the discharge pipe, which being connected to the boilers insures a continuous supply of feed water to the boilers

An improved car coupling has been patented by Messrs. Stephen L Davidson and Chester L. Davidson, of Virden, Ill. The invention consists in the combination, with a drawhead having a recessed side wing for receiving the coupling pin when the same is not in use, of a transverse shaft held on the end of the car, and provided with an arm to which the coupling pin is pivoted. Also in the combination, with a drawhead, of a chain attached to a transverse shaft on the end of the car.

A car coupling of novel device has been patented by Messrs. Ezra Taylor and Asa Taylor, of Indianapolis, Ind. The invention consists of contrivances designed to enable the coupling and uncoupling to be effected from either side or the top of the cars by swinging the link down over the stud pins of the draw bars to couple. The uncoupling is accomplished by means of a crank mechanism attached to the end of the car. The invention also comprises an ordinary link attachment for coupling with cars not provided with the improved coupling.

A novel device for causing steam wheels to run in either direction has been patented by Mr. Samuel J. Webb, of Flat Lick, La. The invention consists of a wheel or drum having two buckets or pistons located on the face at opposite points, and arranged to run in a case partly encircling the face of the drum, and packing steam tight at its edges on the face of the drum, with abutment valves at the end of the case to open automatically by the pistons for allowing them to pass, and with reversing devices for causing the wheel to run in either direction, all being constructed and arranged in a simple, cheap, and durable manner.

A car brake which can easily be applied at any time from any part of the train, and which need not be operated by manual labor, has been patented by Mr. George F. Bond, of Troy, N. Y. The invention consists in a car brake formed of brake shoes attached to the ends of a toggle lever, connected by means of an elbow lever with a longitudinally movable rod held on the bottom of the car and provided with a bumper head at one end. The opposite car is provided with a vertically adjustable bumper head, and when the same is lowered and the cars come together on checking the speed of the engine, the rod is moved longitudinally, the joint of the toggle lever is forced downward, pressing the brake shoes against the wheels.

An improvement upon that class of rotary engines provided with radially moving gates or pistons has been patented by Messrs. James Gillespie and Martin Gillespie, of West Point, Ohio. When the gate reaches its extreme outward movement, it remains in that position from that point to the exhaust port, where the steam is exhausted, and the pressure being at that moment taken by the other gate, the first one is moved readily inward by the eccentric surface of the steam way until it reaches the under side of the wheel, in position for again receiving steam. In this manner a continuous rotation is obtained, and the parts being retained in position by the steam pressure, no springs or other devices that are liable to get out of order are required.

Mr. Eugene Moreau, of San Francisco, Cal., has patented an improved stand for rock drills. The invention consists in a stand for rock drills of novel construction, and in a novel mode of attaching the drill thereto, whereby increased facility is afforded for varying the positions in which the drill is arranged to work, and for holding and securing it in place, and for centering the drill or its support to prevent the apparatus from canting or falling over when not secured, as well as to bring the drill within the compass of the platform, thereby facilitating transportation of the apparatus. The same inventor has also patented a hand rock drill, an improvement upon a patent obtained by him on January 28, 1882. This invention consists in a novel method of automatically feeding the drill, whereby the drill is made to advance toward the rock as fast as required by the progress of the boring. It also consists in a certain combination of swivels and slides with the stand which carries the machine, whereby the machine may be easily and quickly placed in any desired position.

An improvement in rotary steam engines, the object of which is to promote efficiency, durability, and economy of steam has been patented by Mr. Friederich Muller, of Elizabeth, N. J. The invention consists in a drum provided with hinged wings, and a cylinder provided with an interior abutment, having its middle part concaved to fit upon the winged drum, and having its forward end concaved to allow the wings to open quickly and its rear end inclined to close the wings. The interior abutment is provided with two inlet ports—one in the rear of the said forward shoulder of the abutment to admit steam intermittently to open the wings, and be then closed by the wing carrying drum, and the other in advance of the forward shoulder of the abutment to admit steam continuously to drive the engine. The wing carrying drum is provided with channels at the rear edges of its wing receiving recesses to receive steam to open the said wings. The cylinder is made with an eccentric inner surface, whereby the steam space will be gradually enlarged from the inlet to the outlet ports, and the rotary motion obtained.

MECHANICAL INVENTIONS.

An improved automatic advertising device of the following construction has been patented by Mr. William Akin, of New York city. Two clock works, one driving a drum carrying a series of advertising sheets, and so constructed as to display a number of advertisements successively and for fixed times.

An improved tread power has been patented by Mr. Samuel Douglass, of Texas, Mich. This invention consists of a supporting frame carrying a movable platform, a shaft, a spur wheel, and a weight box having a chain and whiffletree. The object of this invention is to render greater power by less expenditure of force than other machines afford.

A novel fanning attachment for sewing or other machines operated by the treadle has been patented by Mr. Stanislas Fossier, of New Orleans, La. The invention consists of a fanning attachment formed of a vertical pivoted rod held on the machine top, in which vertical rod a fan handle is pivoted, and which is connected by a cord with the treadle of the machine. By this device a constant circulation of air is kept up.

A novel machine for drying, cleaning, and calcining grain and other substances has been patented by Messrs. William F. Witherell and Bennett H. Vary, of Chicago, Ill. This invention consists in a revolving hollow cylindrical drier supported in a nearly horizontal position, and provided with hot air tubes and with buckets for distributing the material to be dried or cleaned.

A novel apparatus for raising sunken vessels has been patented by Mr. Henry Schuyler, of Sturgeon Bay, Wis. This invention relates to an improvement in apparatus for raising sunken vessels, by the employment of right and left handed screws carrying alternately ascending and descending bridges, to either of which is connected the hoisting chain or cable, said screws having connected to them driving gear, by which the object is to be raised.

An improvement in folding gates has been patented by Mr. John A. Emery, of Decatur, O. The object of the invention is to intercept the snow and prevent its settling in the space between the sills in which the gate folds, to form a folding bridge over said space for the passage of vehicles, to prevent the bridge from falling back when the gate is raised, and also to combine with the gate certain mechanism that will allow it to be operated from the road without compelling the rider or driver to dismount.

Mr. Thomas W. Steele, of Little Rock, Ark., has invented an improved cotton cleaner for which he has obtained Letters Patent. The invention consists of an endless carrier for carrying the cotton through the machine. The forward part of the machine is covered by a curved casing, and is provided with a toothed shaft to force the cotton out of the receiving chamber. The rear part of the machine is covered with a casing inclosing a toothed cylinder, by which the cleaned cotton is forced out of the machine thoroughly prepared for the gin.

An improvement in knee stops for organs has been patented by Mr. George S. Morse, of Columbia, Mo The invention consists in a device in the knee stop, by which, when applied to the common knee stop, it will open the different hand stops successively; and it consists of an uneven surface or points that come in contact with the different hand stops, opening and closing them successively instead of simultaneously, as is done by the common knee stop, which has its surface plain and all points of contact with the hand stops even.

An improved injector for type casting machines has been patented by Mr. Thomas McKinley, of New York city. The invention consists in the combination, with the pump cylinder or other formed box serving the same purpose, of a sheet metal diaphragm closely secured at its edges to the cylinder or box, and admitting of sufficient vibration of its area within the edges to act as a piston to draw in and expel the amount of metal required by means of a suitable handle or piston rod attached to its center, whereby the difficulties and objections to the process at present in use are avoided.

The invention of a truck for use in the loading, unloading, and transportation of pianos and other heavy articles has been patented by Mr. Lewis E. Huribut, of Fort Dodge, Iowa. The truck is furnished with four supports, at the extremities of which are attached rollers. The supports are adjustable to any inclination according as the truck is to be run up an inclined plane or up stairs, and it is fitted with straps and braces for holding firmly the object placed upon it. When the truck is to be placed upon a wagon for transportation, the legs are folded up altogether, so as not to impede the handling of the article, but when unloaded the legs fall automatically into their proper place, and the machine is at once ready to be put in motion.

An improved mechanism for converting motion, which serves as a substitute for cranks, has been patented by Mr. William W. Borden, of San Luis Rey, Cal. The invention consists in a mechanism which combines a ratchet wheel with a double rack fitted for oscillation for engaging the wheel at opposite sides in succession. With this form of mechanism, power being applied to revolve the ratchet wheels, the rack is given the reciprocating movement. To insure the connection of the opposite rack with the wheel in case the teeth do not coincide when the cam acts, a shifting weight is provided. This weight is pivoted for lateral movement, and, being shifted from one side to the other by the cams, serves to hold the rack against the wheel, so that the teeth shall connect at the first movement of the wheel. Suitable stops are provided to limit the swing of the weight.

AGRICULTURAL INVENTIONS.

Mr. Henry Cole, of Cedar Hill, O., has patented a novel seed planter. The invention consists in the application of dropping attachments and drills to the riding attachment to cultivators, whereby the latter may be utilized as a seed planter. The riding attachment was patented by same inventor February 10, 1880.

An invention consisting in a locking attachment for the beams of sulky and gang plows, having the object of preventing oscillation of the forward end of the beam, whereby the annoyance caused to horses by this oscillation is effectually prevented, has been patented by Mr. Charles W. Post, of Springfield, Ill.

A novel plow attachment by which a double and single plow at will may be had has been patented by Messrs. Edward L. Litton and John J. Brown, of Gaffney City, S. C. It consists of two parallel beams to each of which is attached a plow share, one of which is so constructed that it may be removed at will, so that when required only one furrow will be formed at once. It is of simple construction and the invention may be applied to any form or size of plow desired.

An invention for severing the band, wire, cord, or other material around the bundle of grain when thrown into the feeder of a thrashing machine, to facilitate the feeding of the grain, to cause the automatic operation of the band cutter, and to vary the speed of the feeding operation of the machine, has been patented by Mr. Merrick E. Perring, of Eau Claire, Mich. This invention consists in combining with the feed rolls a hopper affixed to the table, and having concaved or V-shaped troughs provided with cutters, etc.

A cotton chopper of improved form has been patented by Laura A. Collins, of Elmo, and William G. Graham, of Terrell, Texas. The invention consists of a hoe suspended to the axle bar of the vehicle, and connected with the wheel by such a system of mechanism that it performs the work of chopping only at stated intervals, and in such a way as to clear the rows regularly and as desired. The construction of the carriage is simple, and if any of the parts becomes injured or worn out, such parts may be easily repaired or replaced.

A fertilizer compound which serves to prevent rust in cotton, prevents ravages of cut worms, destroys smut and rust germs in wheat, and is a permanent improver of soils, has been patented by Mr. William D. Styron, of Norfolk, Va. The composition consists of the following ingredients: Sulphur, twenty-five pounds; saltpeter, forty pounds; salt, two hundred pounds; kainit, two hundred pounds; bone phosphate, forty pounds; lime, one thousand four hundred and ninety-five pounds. These are all thoroughly mixed together, in a powdered state, by any of the usual methods.

Mr. Anthony O. Stiveson, of Pomeroy, O., has patented an improved harrow. The invention consists of a V-shaped harrow divided in half and so arranged on hinges that in case of an obstructing stone or stump, etc., one-half may be raised, thereby avoiding the necessity of moving the harrow out of its line of work. Likewise the harrow teeth are so arranged, that they may be turned half way round from time to time to sharpen by wear, and furthermore between the parallel bars of each side of the harrow are arranged three toothed rollers at right angles to said bars, set obliquely to line of the draught of the harrow, which latter are self-sharpening by the effect of their double action.

An improved cotton chopper for removing or hoeing out a portion of the young cotton plants, leaving only at regular intervals those plants which are to remain, has been patented by Mr. Henry C. Dyer, of Charleston, Ark. The invention consists of a machine constructed with revolving disks or cutters, and of hoes placed in proper relation to the cutter, and in practice the process is as follows: The machine is drawn by horse power across the cotton rows, and at right angles thereto. The revolving cutters are adjusted on their shafts at a distance from each other equal to the space between the stalks of cotton to be left in the ridges to form a stand, and the hoes are adjusted on their shaft. The revolving circular cutters bear the entire weight of the frame, and mark the ground on a cotton ridge, separating the plants to be removed from those to be left. The hoes follow the revolving cutters, remove the dirt on the top of the ridge and the young plants with it, and the adjacent cutters, forming spaces opposite which there are no hoes, protect the young plants left to form a stand.

MISCELLANEOUS INVENTIONS.

An invention which provides a new and amusing game and permits of various novel combinations has been patented by Mr. George O. Warren, of Fryeburg, Me.

An adjustable table for supporting books and adapted to be attached to a chair, table, or any projection of a piece of furniture, to be adjusted higher and lower, and to have any desired inclination, has been patented by Mr. Henry E. Brown, of Lansing, Mich.

A novel automatic top has been patented by Mr. Louis Townsend, of Evansville, Ind. This invention relates to that class of toy spinning tops which are secured to handles and operated by pulling strings. Means are provided whereby not only one but several tops may be kept continuously spinning in one direction.

A novel needle threading device for sewing machines has been patented by Mr. Henry F. W. Seele, of Rolla, Mo. The invention consists of a circularly movable threader, suspended from the presser bar and so arranged that it may be turned to one side when not required for use. A cutter is also attached to the bar for severing the thread.

A novel picture exhibitor, called a metascope, the object of which is to provide a box for the reception and exhibition of pictures, has been patented by Mr. Edwin W. Morton, of White Plains, N. Y. The invention consists in a box provided with suitable openings and a sliding frame which successively carries the several picture frames below the openings, in order that the picture may be viewed.

A hat holding device to be attached to the backs of seats or chairs has been patented by Mr. Francis A. Reichard, of Brooklyn, N. Y. The invention consists of two disks, having rubber coverings on the inner surfaces, and pressed against each other by a spring or a spring hinge. The rim of the hat is placed between the two disks, and the friction caused by the pressure of the springs holds the hat in place.

A cooking attachment for oil stoves has been patented by Mr. Marion E. Porter, of Leon, Iowa. The improvement consists in a heat transmitter provided with a series of top openings, and with a larger central opening and two central collars projecting in opposite directions, by means of which the heat is diffused to the greatest extent possible. The attachment may be constructed on a small scale for lamps, or can be made for gas stoves.

Mr. Henry McCobb, of New York city, has patented a convenient chocolate package which is an improvement upon a patent granted to same inventor June 20, 1882. The invention consists in a box or package made with a removable cover, and having a grater secured to the flanges of the cover of the box, for pulverizing the chocolate, which flanges likewise serve to prevent the scattering and wasting of the grated substance.

An improved automatic damper to be attached to the cold air box of a furnace has been patented by Mr. George A. Leavitt, Jr., of Newburg, N. Y. The invention consists of a box constructed with such a system of valves and swinging doors that, from whatever direction the wind may come, by means of the various positions which the open door or valve of the box may assume, the current of air will be readily deflected or directed to the cold air chamber leading to the furnace.

An improved device for constructing keys from sheet metal has been patented by Messrs. Thomas Donahue and Charles W. Judson, of Terryville, Conn. A blank is first stamped out of sheet metal, one portion of which is so formed as to be readily turned or folded to form the barrel of the key. The folding is done in the usual way by dies. To make a spindle key the folding is done upon a pin, and the pin is left in the barrel so that its projecting end forms the spindle. These operations can be carried out rapidly and inexpensively, and the key made is both light and strong.

An improvement, the object of which is to provide a new arrangement of seats for vehicles which can be so adjusted that when folded they only occupy the space of the front seat, has been patented by Mr John Moore, of Amherst, Nova Scotia. The front seat, which is mounted on hinges in order that the seat may be raised and tipped forward, is constructed one or two inches higher than the back seat, which latter is so mounted that it may be slid forward to pass directly under the front seat when it is not needed. The front seat is then lowered in place, and the two seats converted into one.

An improved fruit picker has been patented by Mr. Lebreus Simpkins, of Marshfield, Oregon. The invention consists in the placing of a bisected hollow ball, one side of which is fixed and the other movable, upon the end of a tube through which is passed a rod, to the upper extremity of which is attached a spiral spring, the object of the latter being to keep the two cups separate. The other end of the rod is fastened to a lever to which is attached a cord which passes to the operator, by means of which the movable cup is brought in contact with the sharp edge of the stationary section. By this means the picking of fruit may be accomplished without injurying it.

A novel dinner pail has been patented by Mr. Fredrick Reichwein, of New York city. The invention consists of a pail divided into three compartments, in one of which is located a lamp with ingenious devices for raising or lowering the wick, and furnished with a wire covering for keeping the flame from being extinguished by the wind. Above the lamp is the chimney, which is furnished with a non-conducting lining, so that the two other compartments designed to contain food will not be subjected to too great heat. These two chambers are furnished with trays, cups, and other convenient receivers for food. Not only is this pail designed for keeping the provisions warm, but also for cooking them if occasion calls for it.

An improvement in magazine fire arms has been patented by Mr. Josef Schulhof, of Vienna, Austria-Hungary. The cartridge magazine is contained in the stock, which in the case shown is divided into three separate compartments, which are separated by suitable partitions, of which compartments the first contains four, the second five, and the third six cartridges. By utilizing all available space in the stock as many as twenty-five cartridges can conveniently be stored in the stock. All the compartments for the reception of the cartridges are closed by a hinged cover. On one side of the stock a spring is provided within the stock, which throws open the cover as soon as the latch of the same is released. The invention includes other novel points which cannot be described without engravings.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Scientific Books. See page 44. 100 page Catalogue free. E. & F. N. Spon, 44 Murray Street, N. Y.

For press copy, printers delight in a plain open hand. Esterbrook's blunt and engrossing pens are excellent for this purpose.

I want to find a novelty in art materials, mailable and easily prepared, to advertise as a specialty. F. A. Whiting, Wellesley Hills, Mass.

Drop Forgings. Billings & Spencer Co. See adv., p. 45.

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Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau street, New York.

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For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 44.

Gould & Eberhardt's Machinists' Tools. See adv., p. 44.

Pure Grain Nickel, Rolled and Cast Anodes, Pure Nickel Salts. Greene, Tweed & Co., 118 Chambers St., New York.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 44.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 44.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Catechism of the Locomotive. 625 pages. 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N.Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Improved Skinner Portable Engines. Erie, Pa.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Peck's Patent Drop Press. See adv., page 44.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 20.

Contracts taken to Manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

See New American File Co.'s Advertisement, p. 30.

Steam Pumps. See adv. Smith, Vaile & Co., p. 29.

Stone bottles for beer and ink. Merrill & Co., Akron, O.

25" Lathes of the best design. G. A. Ohl & Co., East Newark, N. J.

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"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Engines, 10 to 50 horse power, complete, with governor. $350 to $550. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Brass Finishers' Turret Lathes, 13½ x 4, $165. Lodge, Barker & Co., 189 Pearl St., Cincinnati, O.

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Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description.

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First Class Engine Lathes, 90 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

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Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Cope & Maxwell M'f'g Co.'s Pump adv., page 12.

Curtis Regulator, Float, and Expansion Trap. See p. 12.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 14.

The Sweetland Chuck. See illus. adv., p. 14.

Knives for Woodworking Machinery, Bookbinders, and Paper Mills. Taylor, Stiles & Co., Riegelsville, N. J.

Lace Cutters. A useful little tool for cutting lace leather without waste. Greene, Tweed & Co., New York.

The Curtis Pressure Regulator and Curtis Steam Trap. See page 12.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) C. & B. ask for a formula for coppering malleable iron; also let us know what to use for cleansing iron before coppering. We would like a nice bright color, such as curtain fixtures. A. See SUPPLEMENT, No. 310, where full instructions are published under the head of "Electro-metallurgy."

(2) A. C. asks what to use with paraffine to make it the consistency of a gum. I have tried several experiments, but as yet can get nothing that will mix with it. A. We recommend that the paraffine be dissolved in some menstruum until the desired consistency is obtained. Use some agent like benzol. Paraffine is also soluble in some of the lighter petroleum oils.

(3) H. P. writes: Two ordinary suction pumps, each 3 inches in diameter, are placed side by side; the rod of one is one-half inch, the other 2 inches in diameter. With the same amount of time and labor, which pump will throw the greatest amount of water? A. There will be no difference.

(4) C. G. R. asks: 1. Do the nickel anodes commonly used for plating contain any iron? If so, about what per cent? A. The nickel anodes are generally very pure. They contain, probably, not 1 per cent of iron. 2. In electroplating, if the anode contains iron, will the iron be transferred with the nickel, or remain in the anode as waste? A. In electroplating, the iron is separated out. 3 Can iron be deposited by the electroplating process? A. Iron can be deposited by the electrolysis. See SCIENTIFIC AMERICAN SUPPLEMENT for June 19, 1880; also for October 21, 1882. 4. Does a good nickel plate contain any iron? If so, is it enough to cause rust? A. A good nickel plate does not contain any iron.

(5) H. B. asks: 1. Will the dynamo-electric machine described in SUPPLEMENT, No. 161, generate sufficient electricity to keep one light burning? A. It will run two 8-candle lamps. 2. What is the cost of an Edison, or any other make, lamp? A. We believe they are sold only with a complete illuminating plant. 3. Will a power which is sufficient to run a sewing machine with ease be powerful enough to rotate the dynamo mentioned above? A. No.

(6) T. B. C. writes: Will you oblige by giving simple recipe for painting or washing brick walls red? I want a wash that will not wash off. A. Use oil paints, or add to the usual mixture some glue and bichromate of potassium.

(7) F. J. M. asks: Will you inform me of the best composition substitute for ivory? A. Use celluloid. See SCIENTIFIC AMERICAN, July 23, 1881.

(8) J. S. asks how to tell if buckwheat flour is adulterated with plaster of Paris or anything else. I bought some for the best Pennsylvania buckwheat flour, but it has a peculiar smell and taste. Would like to know how to test its purity. A. Mix about a thimbleful of it in a pint of water in a glass, stir it thoroughly, and when in suspension for a few seconds pour off most of the suspended matter, and the mineral impurities will be found on the bottom of the glass, feeling gritty when rubbed with a spoon or other implement. If the sediment is considerable, the flour may be considered to have been adulterated.

(9) J. V. S. asks: What is the best protection for a wire rope—something to preserve the rope, a protection against wet, to keep it from rusting, and that will also render it pliable and that will add to its durability? I have been using pine tar, but it does not render satisfaction as it pulls off on the drums and rollers. The rope I am using is an endless rope, one and a half miles in length, used for hauling coal. A. To preserve wire rope apply raw linseed oil with a piece of sheepskin, wool inside; or mix the oil with equal parts of Spanish brown and lamp black. To preserve wire rope under water or under ground, take mineral or vegetable tar, add one bushel of fresh slaked lime to one barrel of tar, which will neutralize the acid; boil it well, then saturate the rope with boiling tar.

(10) J. R. M. writes: I have a cistern lined with brick laid in cement, and then plastered with cement. The water tastes too much of lime to use. Is there any way to take the lime out except to soak and then pump out water, and let it refill? A. The best plan is to bear it. The cistern can be emptied, and the sides coated with either asphalt or soluble glass. In this instance it is probable that for a while a tarry odor and taste would pervade the water; and if soluble glass was used, unless of proper degree of neutrality, the tendency would be that the water would dissolve out some of the alkali, which would impart a disagreeable taste to the water.

(11) L. W. B. writes: 1. I am building a vapor stove on the same plan as Dr. Regnard's incandescent lamp, as will be seen in the SCIENTIFIC AMERICAN, vol. xlvi., p. 396. How shall I obtain a large circular blaze without smoke caused by non-consumed gases, thereby making an offensive smell? A. In order to properly answer your question, we would require full dimensions and size of your stove. However, you can (in a general way) follow the plan of the lamp and produce your large incandescent surface by multiplying burners, and not by making one large one. In this manner you will avoid smoke. 2. In ordering the fluid, shall I order as petroleum or benzine? A. Order either benzine or petroleum naphtha.

(12) J. T. S. asks how to make a cheap steam paste. I have been making a steam paste, and it will sour, and the water back up in the pail and come to the top of the paste. What I want is to make a paste which will not sour and back up the water. I want a paste for bill posting and book-binding work. A. Water is first heated to boiling, and the flour is then added, with constant stirring. To prevent the formation of lumps the flour may be passed through a sieve, so as to insure its more equable distribution; agitation is continued until the heat has rendered the mass of the desired consistency, and after a few minutes for the boiling, it is ready for use. To prevent it from souring add a slight quantity of carbolic acid. In order to make a harder paste, one-sixth to one-fourth of powdered resin to the weight of flour is added; or sometimes alum may be used for the same purpose.

(13) J. D. G. asks: What is the best and cheapest way to get smoke out of clothing? A. The best and cheapest way would be simply to expose the articles to the air, hanging them so that they would become thoroughly exposed. They could be exposed in a closed room to the vapor of ammonia, which, to a certain degree, would neutralize the influence of the smoke. The ammonia should be generated by mixing ammonium chloride (sal ammoniac) with calcium oxide (lime) and adding a little water.

(14) E. J. C. asks: What are shoe buttons made of? If a composition, can you give it? A. Shoe buttons are made of papier maché.

(15) W. M. writes: My Smee's battery has become irregular in its action, and I am informed that it is because its silver plate needs replatinizing. How can I do this? A. In SUPPLEMENT, No. 177, will be found the details of this process.

(16) J. B. asks how to make a liquid bluing. A. Dissolve one-half ounce of soluble blue in a pint of water, and add about ten drops of muriatic acid.

(17) G. L. D. asks: How can I change the color of bronze metal while molten to black or brown? A. For the former, stir in sufficient finely powdered magnetic oxide of iron; and for brown, fine peroxide of iron.

(18) J. R. H. asks: 1. How is sodium made, and what are its constituents? A. Lately sodium has become a by-product in the ammonia manufacture; has formerly been produced by heating its oxide with charcoal. It is an elementary body. 2. Will sodium burn in pure oxygen? A. Yes; under any condition. 3. Is it possible to liquefy sodium? A. It may be readily melted under benzole, at a very moderate heat, carefully applied by immersion in warm water. 4. Can hydrate of soda be produced by other bodies than sodium oxide? A. Yes; it may be formed from the compounds of the latter; for instance, from its oxalate by separating this latter by lime water, etc. 5. Is there any process by which oxygen can be produced from pure air economically and rapidly? A. A process which is described in full in SUPPLEMENT, No. 267, is an excellent one. 6. What proportions of air and hydrocarbon gas give the greatest heat, both being under pressure? A. Twelve of air to one of gas give the most heat, but form a dangerously explosive mixture; seven of air to one of gas is the most practicable. 7. Should the orifice for the air be larger, or the pressure greater? and to what temperature should it be heated to give the best result? A. The orifices or pressure should be arranged that seven parts of air to one of gas will be formed. The air may be heated indefinitely, remembering that the higher its heat the less weight of air (or oxygen) to a cubic foot, as it is expanded by heating. 8. A. This question covers many conditions, of which you do not give the detail. See Edwards' "Steam Engineer's Guide."

(19) J. M. M. writes for information respecting recent improvements in autographic printing processes. A. In SUPPLEMENTS, Nos. 143, 146, and 225, under the above head, will be found every detail of these processes.

(20) C. E. T. desires to be informed the method of manufacturing Spence metal. A. Black sulphide of antimony may be fused readily in a charcoal furnace. When melted, an equal weight of sulphur in fine powder is stirred in and the heat continued until all are in a perfect state of fusion, when it may be cast into any suitable form. Sulphide of iron may be used for an alloy, fusing at a higher temperature and accomplished in the same manner as the above, except that the sulphur should be mixed previously with the sulphide of iron, and the cover of the crucible carefully luted on to prevent the ignition of the sulphur.

(21) M. C. S. asks: How are emery wheels manufactured? A. The emery, of suitable degree of fineness, is agglutinated with glue or mucilage, pressed into shape, and then dried or baked.

(22) C. L. T. asks: 1. What is "fix ore?" A. The ore dried and burnt—thus freed from water or sulphur. 2. Are they more valuable than other conditions of the ore? A. Yes; about $1.00 in iron ores. 3. Are hematite ores convertible into steel by the Bessemer process? A. Yes; if their percentage of iron is over 60.

(23) J. K. P. writes: I have an engine, 12 inches by 36 inches, running 65 revolutions per minute, with an 8 foot flywheel. I put on a band wheel, 6½ feet in diameter, bearing the 8 foot flywheel on the same shaft, and run the engine at 80 revolutions per minute. The boiler is 16 feet long and 6 feet diameter, with ninety-six 3 inch flues. A steady pressure of 80 pounds is kept up in the boiler. Do I gain any power? If so, how much (about)? A. If you carry the same pressure of steam, your gain of power is proportioned to the increased speed of the piston as 65 to 80.

(24) W. C. B. asks if five miles of one-quarter inch pipe were laid, and an air cylinder placed at one end, would there be any effect at the other end from one compression of piston, saying nothing as to size of cylinder or power to operate? A. We think not; the friction of the pipe would absorb all the increased pressure from one compression.

(25) Inquirer asks: 1. If superheated steam (decomposed water) be let into a holder (like a gasometer), will the heavier gas settle so one could draw off either of the gases, or will the atoms continue mixed with each other? A. Superheated steam is *not* decomposed water. The gases will not separate. 2 Please tell me, also, if a boat can be propelled by a propeller actuated by foot power like a velocipede, without much exertion? A. It can be propelled, but to obtain a given speed the same power must be applied as by any other mode.

(26) C. A. A. writes: 1. I have purchased a second-hand portable boiler and engine—10 horse power. The fire passes directly through the flues and up the smokestack, and directly under stack and at rear end of boiler and at the bottom is a hand hole for cleaning; it has not been removed for years. On the outside and around it is coated with a substance that cuts like rock with a cold chisel. Is it safe to let it remain in that condition and use it? A. It is not safe. You should take it out to examine its condition. 2. Is steam considered good for cleaning flues? A. Yes; if introduced from another boiler, and the scale subjected to the action of the steam a number of hours till the scale is soft.

(27) R. H. asks how to make gilding for watch plates, and how to apply it. A. The following gilding solution, to be used at a temperature of from 120° to 180° Fahr., has been recommended by M. E. Rod: Crystallized sodium phosphate, 60 parts, by weight; sodium bisulphide, 10 parts; potassium cyanide, 1 part; gold chloride, 25 parts; distilled or rain water, 1,000 parts. To prepare this bath properly the water should be divided into three portions—one of 700 parts, and two of 150 parts, by weight. The sodium phosphate is dissolved in the first portion, the gold chloride in the second, and the sodium bisulphide and the potassium cyanide in the third. The first two portions are gradually mixed together and the third is afterward added. With this solution M. Rod uses a platinum anode—a wire or strip—adding fresh portions of the gold salt as the solutions become exhausted. Spons' Encyclopedia treats this subject very fully, p. 578. A book by J. W. Urquhart on "Electroplating," London, 1880, is good authority; also Gee's "Practical Gold Worker."

(28) G. F. D. writes: I wish to make a cement to coat the inner side of a lead tank which leaks. Will a saturated solution of silicate of soda made into a paste with powdered glass answer? If not, please let me know what is the best cement for such purpose. A. Silicate compounds cannot be recommended for this purpose. If the tank can be tipped over so as to get at the leaky places with a soldering iron, soldering is the only proper and sure remedy. If the leaky places cannot be soldered, then the next best is two or three coats of metallic paint, thoroughly dried. Asphalt varnish or coal tar also makes a very good covering for lead lining.

(29) P. D. writes: What is dead oil? How is it produced, and for what purpose employed? A. It is one of the distillates of coal tar. Its use is principally for the preparation of naphthaline and carbolic acid, and also as an adulterant. Its commercial value is small.

(30) R. B. A. writes: Please describe how to use the method of silvering the backs of looking glasses. A. A sheet of tin foil, of the same size as the glass to be silvered, is laid perfectly level upon a table and rubbed over with metallic mercury, a thin layer of which is afterward poured upon it. The glass is then carefully slid on to the table, so that its edge may carry before it part of the superfluous mercury with the impurities upon its surface; heavy weights are laid upon the glass, so as to squeeze out the excess of mercury, and in a few days the combination of the tin and mercury will be found to have adhered firmly to the glass.

(31) M. D. H. asks for a receipt for making a good and cheap liquid drier; also a dry drier, which, when mixed with linseed oil, will make it dry quickly and very hard. Please give the amount used to each gallon of oil. A. For the liquid drier, boil one gallon of linseed oil for an hour with a pound of finely powdered binoxide of manganese. For a solid drier, use borate of manganese in powder or mixed in oil.

(32) W. C. asks: Can you give a simple formula for bleaching fat, discolored by the vegetable matter from the entrails of the animals from which it is taken? A. About five per cent of ordinary sulphurous acid mixed with the fat, and when the latter is melted by stirring, will answer your purpose. Continue your heat until the fat no longer smells of the gas. If necessary, a greater or less quantity may be used, it being perfectly harmless for after uses of the fat.

(33) G. P. F. writes: I find in No. 8 of the last volume of the SCIENTIFIC AMERICAN a recipe for ebonizing; the meaning I do not quite understand. You say, "then oil, and fill in with powdered drop black mixed in the filler." Will you answer what kind of oil is meant, and whether you put oil in drop black or have them separate? A. Use boiled linseed oil, and mix it with the drop black.

(34) J. F. asks: 1. Will the inside wheels of a car or locomotive slip on a track when running around a curve. A friend of mine says he don't see how they can. He says when a locomotive is running around a curve, the flanges on the outside wheels press against the side of the outside track; he says this brings the large part of the taper or bevel of the outside wheels and brings small part of the bevel of the inside wheel, bringing the wheels in this position; he says he don't see how the inside wheel slips on the track, for, he says, the outside wheel has a larger circumference on the track than the inside wheel, therefore the inside wheel would not have to travel as fast as the outside wheel. A. Your friend's explanation would be correct if all the curves were of the same radius and the coning of the wheels fitted for that radius; but as this is not the case, there is always more or less slip in running a curve. 2. Will a locomotive tend to run to the low side of the track when the tracks are not level? A. No; if running on a straight stretch of road. 3. Will a locomotive push ahead when steam is let in the cylinders, before the driving wheels turn? A. No.

(35) J. C. D. asks: 1. Will you explain to me on which quarter of the stroke the piston of an engine moves the farthest, and the cause of its doing so? A. The difference of travel on the different quarters of the stroke is caused by the angularity of the connecting rod, and the amount of the difference is governed by the length of the connecting rod in proportion to the stroke of the piston. Lay down a diagram of the arrangement, and you will see at once the cause of the difference. When the piston is in the middle of its stroke, the crank is not at right angles to the center line, but at a slight angle from the right angle. 2. Also, in regard to steam pressure in boilers. I have been informed by a party that is supposed to be reliable and well posted in the properties of steam, that in addition to what a correct steam gauge would indicate, there was an actual additional pressure inside of a steam boiler of the amount of the atmospheric pressure, and that at, say, 60 pounds steam pressure, the actual pressure or strain on the inside of the boiler would be 75 pounds. A. Your friend is right. There is about 15 pounds more pressure per square inch in the boiler than shown by the gauge; but as this is balanced by the pressure of the atmosphere on the outside, it exerts no bursting pressure on the boiler.

(36) R. W. H. writes for directions for bronzing cast iron and to give it a greenish shade. A. In SUPPLEMENT, No. 235, full directions as to details in regard to this process may be found.

(37) H. G. M. writes: I am in the canning business, using steam retorts. Pressure on retort, five pounds durin thirty minutes process; at starting, steam gauge on boiler indicates 15 pounds pressure; during time of process, steam rises in boiler to 40 pounds. My gauge on retort indicates 5 pounds steadily. Query: Do I get any greater heat in retort when the pressure on boiler is at 40 pounds than when at 15 pounds? If I should increase the pressure on the retort to 10 pounds, what variation in time would be required to give the process as at 5 pounds pressure for thirty minutes? Do I get superheated steam by carrying it in a pipe from the top of the dome of the boiler, back down into the same boiler, and then out through the dome to my retorts? Do steam gauges need oiling? If so, how applied? I notice the hand on one of my gauges catches at about 5 pounds pressure and then with a jump will go up three or four pounds. A. The temperature of steam at 15 pounds pressure is 251° Fahr. You can only get the heat in the retort due to the pressure in the retort. Your gauge must be out of order, or it would indicate the increase of the pressure in the boiler, provided the pipe to the retort from the boiler is not throttled. The heat due to steam at 5 pounds pressure is 228°, at 10 pounds 241°, which would quicken the operation. You cannot superheat the steam by passing it through the steam chamber in a pipe as you propose. It must be passed through a hotter medium than the steam itself. A watchmaker ought to be able to put your gauge in order, if there is only a catch in the movement.

(38) A. P. writes: A few weeks ago a correspondent requested you to send him a receipt for a dip to color brass black, and you advised him to try a weak solution of permanganate of potassium and a very dilute solution of nitric acid I have tried it, but without result, as it would not color one particle. I take pleasure in giving you a good receipt for a dip to color brass black that will not rub off: Dissolve two pounds blue vitriol in three gallons of hot water, and add one and a half gallons of potash, mix these two ingredients well together while hot, and let it stand till cold, and add to it one pint of aqua ammonia, and it is ready for use. It will color brass black in about from twenty to twenty-five minutes. The articles must be taken out of the dip as soon as they are sufficiently black, otherwise they will turn brown if left too long. This dip is good for brass, but does not answer for bronze. A. You did not employ it in the proper manner. Your receipt is excellent, however.

(39) J. J. S. asks for a receipt for thoroughly deodorizing lard. A. Fats which are rancid may be improved by treatment with hydrogen peroxide. Many other substances are recommended, but none are entirely satisfactory. Chlorine water is sometimes used, but the introduction of chemicals is not considered advisable.

(40) M. H. asks, 1, how to clean Roman gold that has become tarnished, ammonia not having the desired effect. A. Dissolve cyanide of potassium in about ten parts of cold water and wash the articles with it. N. B. As this salt is a powerful poison, care must be used in employing it, that it does not come in contact with your hands, etc. 2. What will remove freckles without injuring the skin? A. There is nothing that accomplishes this satisfactorily. The following preparation has been recommended: Subcarbolate of zinc, 2 parts; glycerine, 25 parts; rose water, 25 parts; and alcohol, 6 parts. It is to be applied twice a day, and allowed to remain on for about a half hour, when it is to be washed off.

(41) A. C. D. writes: 1. I am thinking of building a steam launch for trawl fishing on this coast; she will be 35x7x4 feet, engine compound, 3x3 and 6x6. I wish to have an inboard surface condenser. What size should it be, and is brass the best metal for its tubes? Would a cylinder 3 feet long, 6 inches diameter, with 50 ⅝ inch water tubes through it—which is best, to draw or force the water through it? I was thinking of putting a vertical centrifugal pump, mounted on main shaft. What size should it be? Would 2 inch injection and discharge be large enough? The air pump would be independent. I thought of putting in a No. 00 Knowle's, which would also exhaust into the condenser. Would a boiler of the return tubular type, say 4½ feet long, 3 feet diameter, firebox 16 inches by 2 feet, 12 3-inch flues 2 feet long, and 30 2-inch return tubes, be too much; boiler fuel soft coal, natural draught? I would like an easy steaming boiler. About what power would she develop. I make her 9 horse power at 80 pounds pressure, 400 revolutions, but by a rule in use here for finding the approximate I. H. P., viz., $H=\left(\frac{A\times L\times P}{35}\right)\frac{2}{3}=14$ nearly, where A=sum of squares of diameter of cylinder, L=length of stroke in feet. P=pressure per square inch. H=I. H. P.; 35 is a constant which I fancy gives too much. About how much coal should I burn, and what speed could I attain? A. You should have 40 to 50 square feet condensing surface. Brass tubes turned on both sides. We think your tubes should be not less than half an inch diameter. It makes little difference which way the water is sent through tubes. A centrifugal pump will answer well; 2 inches delivery would be large enough. We think your boiler would steam very well, but would recommend increasing it at least 10 or 15 per cent. We think your estimate of 9 horse power not quite high enough. Are you not mistaken in the formula? Is it not A=square inches area of the two pistons, instead of square of diameters? If so, =then $14\times0{\cdot}7854=10{\cdot}99$ H. P.

(42) H. A. C. asks: For bending, does the timber have to be seasoned before steaming? How long does the timber have to be kept in the steam box before it is ready to bend? A. No special machinery is required for bending plow handles, further than a wooden form to bend over and an eye to hold the end with a hook to catch the long end and hold it, all of which may be home made. The timber does *not* required to be seasoned. The handles, if green, require steaming long enough to heat them through, possibly one hour. If they are dry, they should be soaked in warm water at least one day before steaming, then two to three hours' steaming should be enough. Much depends upon what kind of timber the handles are made of. Those that make a business of bending and making plow handles, make them double to prevent splitting the ends by bending close to the end, and afterward cut them. Often a piece of band iron is placed on the convex side of the wood, and bent with it to prevent splintering.

(43) J. S. H., Jr., writes: 1. I would like a receipt for a wall paper paste. A. Four pounds of fine wheat and flour are mixed with a small quantity of cold water, thoroughly stirred; two ounces of powdered alum are then added, and when dissolved, a gallon of boiling water. When cool, it may be thinned as desired with cold water and used. 2. Also a receipt for putting an egg shell polish on fancy woods. A. Three parts of shellac, one part of gum mastic, and one part of sandarac gum are dissolved together in forty parts of alcohol and form a beautiful polish, which may be applied with a brush or cloth. 3. A receipt for painting or coloring borders on floors. A. Use fine umber mixed with oil and a little turpentine, this being the prevailing color. 4. How can I gild wood work? A. This is rather a difficult operation to do satisfactorily, but may be accomplished in the following manner. Dampen the wood with a little gum water, and with great care transfer the gold leaves from the book to the wood, lightly pressing them upon it with a fine brush.

(44) H. J. L. asks: 1. What materials, and in what proportions, are used for making the brown heads of parlor matches? A. Fine glue, 2 parts; water, 4 parts; phosphorus, 1½ to 2 parts; potassium chlorate, 4 to 5 parts; powdered glass, 3 to 4 parts; red lead mixed with litharge to suit in color. 2. How can the mixture be changed to make it ignite by very slight friction? Or of what materials can a similar composition be made which will do so? A. Increase the phosphorus and diminish the potassium chlorate.

(45) J. J. H. writes: I have seen a mention of a positive ferroprussiate, or reversed blue process paper, giving dark blue lines on a white paper background. Can you give the preparation for the paper (the composition of the solution and process)? A. The following is said to be good: Well sized paper is painted over with a brush with the following solution, freshly prepared: 30 volumes of gum arabic solution (1 to 5), 8 volumes solution of citrate of iron and ammonia (1 to 2), 5 volumes solution of perchloride of iron (1 to 2). The mixture appears limpid at first, but soon grows thicker. The paper is dried in the dark, then exposed for a few minutes under a negative or drawing, and developed with a solution of 1 part ferrocyanide of potassium in 5 parts of water, applied with a brush. It is fixed with dilute hydrochloric acid, 1 to 10, washed thoroughly, and dried.

(46) M. J. D. asks: 1. How can a good furniture polish for cleaning, polishing, and filling old furniture be made? A. Rub a coat of shellac varnish into it and smooth off with fine sand paper; then apply a coat of polish made by mixing a half pint of fine shellac varnish with a quart of boiled linseed oil. 2. How is starch polish made, as used for imparting a gloss to shirt bosoms, etc.? A. To ordinary starch, for each quart, one ounce of silicate of soda solution is added and thoroughly mixed. 3. How can I make a solid and also liquid laundry blue? A. Soluble Prussian blue in powder for the former, and one ounce of the same blue to a pint of water, to which one ounce of hydrochloric acid has been added, for the latter. 4. How is stove polish paste for cleansing and polishing stoves made? A. Finely powdered black lead mixed to a paste with water in which a small amount of glue has been dissolved. 5. How is soap powder made, something similar to pearline, soapine, etc., used for cleansing cloths? A. Washing soda is the principal ingredient in these mixtures, and more or less powdered soap—say equal parts of each.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. R. B.—*a* is quartz holding a small amount of copper pyrites, possibly containing gold. An assay would be advisable. *b* is similar to *a*, but richer. *c* is ordinary trap rock, holding iron pyrites of no value. *d* is similar to *c*.—H. K.—The mineral is graphite, containing pyrite. The latter may carry gold.—G. T. S.—The quality of the clay is excellent, and it would possess much value for brick or similar pottery ware.—E. S. M.—The mineral is decomposed feldspar.

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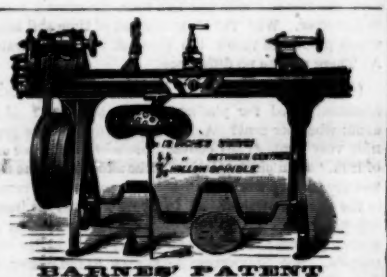

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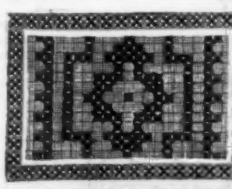

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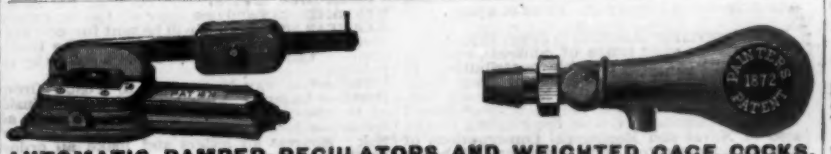

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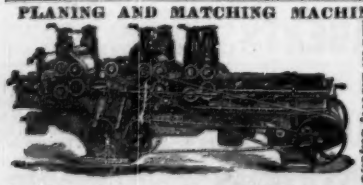

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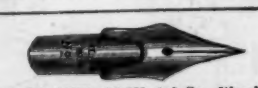

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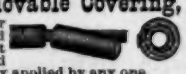

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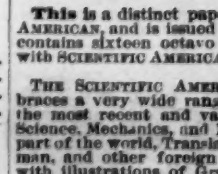

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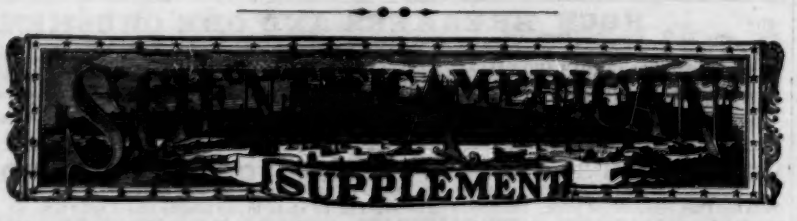

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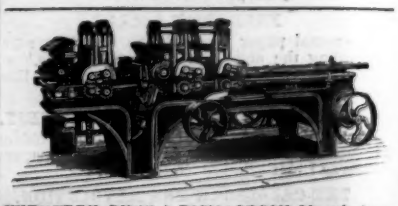

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